

Mid-South Community College  
Right Skills Now – Bridge to Employment  
Process Technology Certifications

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## Table of Contents

Introduction.....	2
Background: Mid-South Process Technology Program .....	3
Industry Demand .....	4
Target Occupations.....	5
Education Requirements.....	5
Process Technology Curriculum / Programs .....	6
NAPTA/PTEC Curriculum.....	6
Mid-South Community College – Process Technology Programs.....	7
Review of Process Technology Programs at Comparable Institutions .....	10
Competencies and Skill Requirements .....	13
National Skills Certification System .....	13
MSSC, ASQ, and ISA .....	14
Process Technology Career Pathways .....	18
Mid-South Community College Process Technology Education and Career Pathway .....	19
Summary and Recommendations.....	20
Appendices	
Appendix 1: Greater Memphis Process Technology Employer Forum.....	21
Appendix 2: Process Technology Occupations .....	25
Appendix 3: Manufacturing Competency Model/DOL.....	30
Appendix 4: Process Technology Competency and Credential Crosswalk.....	31
Appendix 5: Process Technology Competency Categories.....	33



## Introduction

With the objective of designing and implementing programs to promote skills development and employment opportunities in fields such as advanced manufacturing, science, technology, and engineering, Mid-South Community College (Mid-South) was awarded a three-year, \$2.5 million grant from the U.S. Department of Labor (DOL) Trade Adjustment Assistance Community College and Career Training (TAACCCT) Grant Program. DOL is implementing and administering the grant program in coordination with the U.S. Department of Education.

Mid-South President, Dr. Glen Fenter, at the time of the grant announcement declared, “This grant gives our institution an unprecedented opportunity to enhance our ongoing efforts to build a world-class workforce in our region. Industry experts have been telling us for several years there is a serious skills gap within advanced manufacturing and related fields. The TAACCCT grant will give us the resources we need to help fill some of those gaps.”

Mid-South is collaborating with The Manufacturing Institute (MI) on the TAACCCT grant to implement the NAM-endorsed Manufacturing Skills Certification System designed to provide individuals with nationally portable, industry-recognized certifications combined with for-credit education programs. The focus areas for the grant are:

- Development of articulated education pathways that deliver competency-based, stacked, and latticed credentials recognized by critical industry sectors and related associations.
- Development of training programs targeted to the real needs of employers with “middle-skill” jobs, a classification projected to account for nearly half of all job openings nationwide over the next decade; positions that require more than a high school diploma, but less than a four-year college degree.
- Development and sustainment of a rich cross-alignment between education and employers with third-party certifications as a bridge in addressing the skills gap between the labor force and targeted, high tech industries.
- Development of a workforce that is competitive and relevant for the 21<sup>st</sup>-century economy.
- Assurance that the college, related institutions, and regional industry move forward with industrywide certification standards to enhance regional, national and global competitiveness.
- Establishment of strategic partnerships with regional employers for successful implementation and to enable them to be globally competitive for the optimal development of the regional economy.

Working with area industry and business organizations, Mid-South identified machining and process technology programs as being the most critical areas of demand for skills development in accelerated programs. Mid-South contracted with the Manufacturing Institute for technical assistance and support in evaluating academic programs and mapping career pathways pertaining to Machining and Process Technology. The Manufacturing Institute, with the approval of Mid-South, subcontracted with Thomas P. Miller and Associates (TPMA), a consulting firm that specializes in workforce development research and analysis, to prepare a summary report about Process Technology programs.

This report consists of the following components to inform Mid-South on how to best design an accelerated career pathway for process technology:

- Analysis of Mid-South's current/proposed process technology program
- Analysis of national, industry-recognized certifications
- Summary findings from best practice community and technical college process technology programs
- Recommendations for Mid-South process technology programs
- Career pathway for process technology

### **Background: Mid-South - Process Technology Program**

Mid-South is a public, two-year postsecondary institution located in West Memphis, Arkansas, with an annual enrollment of approximately 2,000 students. Mid-South was founded in 1992 and is a comprehensive community college serving Crittenden County, Arkansas, with a population of 49,746 (US Census Bureau, 2013) and the Memphis Metropolitan Statistical Area (MSA), the 41<sup>st</sup> largest MSA in the United States with a population of 1,341,746 (US Census Bureau, 2013).

In addition to two-year associate degrees, Mid-South offers certificates of proficiency and technical certificate programs in a variety of career fields. Although Mid-South had relevant equipment to conduct process technology training, structured programs did not previously exist. Program development at Mid-South began last year and included discussions with local manufacturers, review of curriculum and standards from the North American Process Technology Alliance (NAPTA), and preliminary development of core courses for an accelerated certificate of proficiency. In collaboration with the Manufacturing Institute and TPMA, additional employer outreach and engagement has been conducted and, as summarized in this report, an analysis of process technology curriculum, competencies, and skill certifications was also completed.

To effectively design and implement a workforce development training program, the college must first understand the needs of regional employers, identify targeted occupations and essential skills required to perform job tasks, and ensure appropriate assessment measures are in place to validate attainment of skill and award relevant credentials to program graduates.

## **Industry Demand**

For the purpose of determining current and future demand for process technicians, understanding the range of positions in greatest need, and identifying minimum education/skill requirements across the region, an employer forum was held on October 9, 2014. The Process Technology Employer Forum was conducted in collaboration with the Manufacturing Institute, the Greater Memphis Chamber, the Greater Memphis Workforce Development Institute, and regional educational partners. See Appendix 1 for a complete summary and survey results from the forum.

Based on input received at the employer forum, demand for process technicians and related occupations in the Memphis region is quite high. The majority of responding manufacturers indicated that it was difficult (23% in agreement) or very difficult (46%) to recruit/hire process technicians, with the remaining respondents (31%) noting it was somewhat difficult. Annual hiring needs were found to be diverse, with a minimum average of 80 open process technician positions available each year, with demand expected to increase (significantly 33%, slightly 47%) in the future.

Regional manufacturers utilize a variety of hiring methods including external hires and advancement of incumbent employees. The majority (61.5%) of manufacturers surveyed noted their minimum education requirements for hiring of process technicians was a high school diploma, with 31% noting some technical training. Meeting or exceeding this minimum requirement should greatly enhance employment opportunities for Mid-South program graduates. However, input from manufacturers also highlighted the need for employment candidates to have relevant experience. Half (50%) of the survey respondents noted a minimum requirement of 1-3 years of experience and 21% seek 4-5 years. With 21% of respondents requiring only 0-1 year of experience, the availability of entry level positions for individuals with little or no prior manufacturing experience may be somewhat limited. Mid-South should further explore experiential hiring requirements to (a) identify specific manufacturers who will consider hiring individuals upon completion of training, (b) identify the specific skills needed by manufacturers that are typically gained through work experience, and (c) incorporate internships, hands-on and simulated training for the purpose of increasing experiential learning to meet employer needs.

Regional manufacturers should be further engaged to confirm the types of entry level positions that are available at each step of the Process Technology pathway, and the minimum or desired competencies required for these positions. This will provide the college the opportunity to modify and align their certificate programs to meet immediate entry-level employment needs. For example, if the primary entry-level process tech position in the region is focused on quality inspections, the level one certificate would enhance curriculum related to auditing and process improvement and decrease emphasis in another area, such as electrical systems. Continued employer engagement should also be focused on increasing opportunities for facility tours, guest speakers, capstone or related class projects, internships, and interviewing/hiring of graduates.

To enhance collaboration among regional education partners, particularly Southwest Tennessee Community College and the University of Memphis, it is suggested that a regional process technology advisory council be established. As per the employer forum summary, seven members of the Greater Memphis Chambers' Manufacturing Council expressed interest in participating in an advisory capacity. Additional organizations, from diverse industry sectors, should also be invited to provide input and ongoing support of process technology programs.

### **Target Occupations**

As previously discussed, further research is needed to identify and validate the specific process technology positions that are available in the Greater Memphis region. This information should be gathered through survey/discussion with employers/advisory committee members. The duties of a process technician can vary widely with differences found among industry sectors and individual companies. In addition, companies may not directly employ process technicians. For example, companies often assign process technician duties to other positions, such as quality technicians, operators, instrument technicians, maintenance technicians, and engineers.

For purposes of this analysis, a number of relevant occupations were reviewed utilizing the U.S. Department of Labor's Occupational Network (O\*Net). The following positions relevant to Process Technology were reviewed:

- Chemical Plant and System Operators (SOC #51-8091). Reported job titles include: Operator, Chemical Operator, Process Technician, Process Operator, Operations Technician, Process Development Technician
- Petroleum Pump System Operators, Refinery Operators, and Gaugers (51-8093)
- Biofuels Processing Technicians (51-8099.01)
- Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders (51-9012.00)

A summary of job tasks and required knowledge and skills for these positions is included in Appendix 2. Overall, success in these positions requires knowledge of production and processing, mechanical, computers/electronics, public safety, and technical math. Common skills include operation monitoring and control, analysis and critical thinking, problem solving and decision making, reading and writing.

### **Education Requirements**

On a national basis, 20-30% of these positions require an associate's degree or postsecondary certificate, and 60% of people in these positions possess a high school diploma with no postsecondary education. This correlates to regional data obtained from the employer forum wherein 31% of companies required some technical training for hiring process technicians and 61.5% of companies noted a high school diploma is the minimum education requirement. None of the participating companies require a college certificate or associate degree, but one noted a bachelor's degree as the minimum education requirement.

Although the majority of regional employers only require a high school diploma for entry-level employment, relevant training, skill acquisition, and certifications will greatly enhance employment opportunities for individuals.

## **Process Technology Curriculum / Programs**

### **NAPTA/Process Technology Curriculum**

The North American Process Technology Alliance (NAPTA) is an organization of process technology (PTEC) education providers and their business, industry, and community advisors cooperatively working toward their common goals. NAPTA objectives include:

- Develop standards for PTEC programs that assure quality graduates and regularly evaluate conformance to those standards.
- Evaluate and improve the NAPTA curriculum and supporting educational materials to meet the needs of our industry and educational partners.
- Participate in activities that advance process technology career awareness.
- Drive instructional excellence by providing professional development opportunities.
- Promote NAPTA resulting in increased partnerships with educational institutions, industry, and others.

The NAPTA is the standard-bearer of the PTEC curriculum. It audits PTEC degree programs in North America and endorses those that meet its criteria. Several colleges have received the NAPTA endorsement. NAPTA offers a variety of instructional products to meet the needs of the process industries and the core classes associated with a degree in process technology. It also offers a Knowledge Assessment and Remediation (KAR) Tool which can be used to measure the knowledge and abilities of process technology program graduates, and provide targeted remediation as needed.

NAPTA encourages institutions that offer a two-year degree in process technology to include an eight-course technical core as part of the degree. The NAPTA core includes:

- Introduction to Process Technology
- Process Technology I - Equipment
- Process Instrumentation
- Process Technology II - Systems
- Safety, Health and Environment
- Process Technology III - Operations
- Quality
- Process Troubleshooting



The NAPTA curriculum is robust and comprehensive, but allows for customization to emphasize knowledge and skills critical to local industry. Mid-South is utilizing NAPTA PTEC curriculum and materials as the foundation of its certificate and degree programs in Process Technology with a goal of becoming a NAPTA endorsed education provider.

To enhance student learning and acquisition of skill, Mid-South will be utilizing its “Continuous Flow Micro-Biodiesel Refinery” for practical, applied, hands-on instruction. The operating refinery includes a complete arrangement of process technology equipment and instrumentation and is monitored and controlled from a fully functional Centralized Control Room with an advanced Distributed Control System (DCS). This micro-biodiesel plant provides a unique opportunity to deliver competency-based operations and maintenance training to individuals starting their career in process technology or to those looking to enhance their skills. As a supplement to course curriculum and the refinery lab, Mid-South is utilizing Simtronics software. The Simtronics system was designed specifically for process industries and provides relevant simulation and training in instrumentation and equipment. This simulator training will enhance learning for program participants.

### **Mid-South Community College – Process Technology Programs**

The Process Technology Program at Mid-South is being developed to provide specialized workforce training to meet the needs of industry. The program was designed to include provision for accelerated completion of entry-level training to meet immediate hiring needs, and to provide a series of stackable certificates that ultimately lead to an Associate of Applied Science degree. The programs originally proposed by Mid-South included:

- Certificate of Proficiency in Process Technology – Level 1
- Certificate of Proficiency in Process Technology – Level 2
- Certificate of Proficiency in Process Technology – Level 3
- Certificate of Proficiency in Process Technology – Level 4
- Certificate in Process Technology
- Associate of Applied Science in Process Technology (or General Technology)

#### **Certificate of Proficiency in Process Technology – Level 1**

The first certificate of proficiency focuses on the knowledge and skills required for entry level employment as a “process operator in training.” The program was designed to be completed in one semester to accelerate preparedness for employment. The program curriculum was originally modelled after the Process Technology program at Lewis and Clark Community College and included the following courses:

<b><i>Course Title / Description</i></b>	<b><i>Credit Hours</i></b>	<b><i>Contact Hours</i></b>
Introduction to Process Technology	2	60
Safety, Health & Environment (including OSHA 10 certification)	4	120
Process Technology I – Equipment	3	90



Electrical Fundamentals for Process Technology	2	60
Mechanical Fundamentals for Process Technology	2	60
Principles of Quality	1	30
<i>Total:</i>	<i>14</i>	<i>420</i>

During development, the program was revised to include the courses noted below. The program was increased to 18 credit hours which would likely decrease the possibility of students successfully completing the program in a single semester. The revised program increased content related to Process Quality (versus an introduction to quality principles), added Process Instrumentation, and removed both Electrical and Mechanical Fundamentals courses. As previously mentioned, additional input from regional employers is needed to finalize and confirm a “Right Skills Now” entry-level certificate program. The content of the certificate program should reflect the primary occupations and job skills needed in the region. For example, if the primary entry-level position emphasizes equipment maintenance, Mid-South would want to include electrical and mechanical fundamentals in its level 1 certificate program.

The current program outline for Mid-South’s Level 1 certificate of proficiency is noted below. It is assumed that one of the highlighted (\*) 3 credit courses has been expanded to a 4 credit course, or that a 1 credit career preparation course has been added to the program, resulting in an 18-credit hour program. As the purpose of the certificate program is for students to quickly gain the skills needed for entry level employment, a career preparation component would be strongly suggested.

<b><i>Course Title / Description</i></b>	<b><i>Credit Hours</i></b>	<b><i>Contact Hours</i></b>
Introduction to Process Technology	4	120
Safety, Health & Environment (Including OSHA 10 certification)	4	120
Process Technology I – Equipment	3*	90
Process Instrumentation I	3*	90
Process Quality	3*	90
Career Preparation	1*	30
<i>Total:</i>	<i>18</i>	<i>540</i>

### **Certificate of Proficiency in Process Technology – Levels 2, 3, and 4**

Mid-South originally proposed 3 additional Certificates of Proficiency in Process Technology. The second level certificate would prepare individuals for entry-level positions as process operators (without supervision), and level 3 and 4 certificates of proficiency would prepare individuals for employment as process operators and process technicians. These certificates are under development at this time. Preliminary outlines were proposed by Mid-South; however, changes made to the level 1 certificate would impact these outlines and therefore require revision.

As the NAPTA curriculum has 5 additional courses, not included in Mid-South’s Level 1 Certificate program, it is recommended that Mid-South create a level 2 Certificate of Proficiency in Process Technology to include the following courses:

<b>Course Title / Description</b>	<b>Credit Hours</b>	<b>Contact Hours</b>
Process Instrumentation II	3	90
Process Technology II – Systems	4	120
Processing Technology III – Operations	4	120
Process Troubleshooting	3	90
Process Elective / Internship	4	90
<i>Total:</i>	<i>18</i>	<i>540</i>

It is further suggested that no additional certificates of proficiency in process technology, beyond level 2, be created. If an additional certificate is desired and needed to meet industry needs, a technical certificate would be recommended. Mid-South originally proposed a certificate in process technology, which is assumed to be a technical certificate. The technical certificate would include completion of core occupation-related courses, such as those included in the level 1 and 2 CPs noted above, as well as core general education courses including English composition, technical math, and oral communication. This would result in a 46 credit hour program that would enable students to complete the two certificates of proficiency and “transfer” the 36 technical credits earned, and then complete 10 general education credits to earn the technical certificate in process technology.

Dependent on the hiring and skill needs of regional employers, along with minimum hiring requirements, the college could consider a variety of options for process technology program offerings. This includes:

- Two certificates of proficiency (levels 1 and 2), a technical certificate, and an associate degree (as described above)
- Two certificates of proficiency (levels 1 and 2) and an associate degree
- One accelerated certificate of proficiency (level 1), a technical certificate (inclusive of all CAPT courses), and an associate degree

The specific courses (and course content) that would be included in each process technology program would again be dependent on the specific needs of regional employers. Based on the primary skill requirements and job tasks of targeted process technology positions, along with core process technology competencies, additional coursework (beyond the two certificates of proficiency detailed previously) might include: Technical Math, Measurement Instruments, Electrical and Mechanical Fundamentals, Machine Maintenance, Control Systems / Automation, Chemistry, Physics, Advanced Quality Systems and Process Auditing, and Technical Writing.

#### Prerequisites / Entrance Requirements

Prior to implementation of the process technology certificates, Mid-South should further consider program entrance requirements. Presently, students are only required to have a high

school diploma/GED to begin a certificate training program. However, due to the nature of process technology and technical requirements, sufficient math and writing skills are essential to success. In addition, many manufacturers require employment candidates to complete a pre-hire assessment which typically includes basic math skills. As has been seen in West Memphis and nationally, basic academic skills are generally low and students are not adequately prepared for college success. As such, remedial and developmental instructional programs will likely be required.

As the proposed certificate programs will create a career pathway for students, the college must determine at what point students will be assessed for math and English skills and complete developmental coursework if required. Consideration should be given to include developmental level math and English courses as a prerequisite or integrated into the Certificate of Proficiency. A complete analysis of this issue was not a component of the TPMA study, but as a point of reference, a number of comparable academic programs require minimum scores on the ACT WorkKeys National Career Readiness Certificate (NCRC) which includes assessments for Applied Math, Reading for Information, and Locating Information. For example, Delta College and Laramie County Community College both require NCRC scores at the silver (4) level. The ACT WorkKeys program also allows students to remediate and improve their comprehension (and test scores) through use of the online WIN system. National best practices for basic skill development include the Integrated Basic Education and Skills Training (I-BEST) or the Scientific Management Technologies (SMT) programs.

Recognizing the issues the college faces with a fairly large population of low skill individuals, and the difficulty retaining students who require extensive basic skills remediation, a basic readiness course may provide a solution. A Manufacturing Readiness course could be included in the certificate program or be scheduled prior to start of the certificate program with students placed in the course based on entrance scores. The readiness course would emphasize (a) basic and contextualized math skills, (b) basic computer skills to increase independent learning and success utilizing computer-based training modules and simulators, and (c) study skills, time management, and “life” skills to proactively address issues that may impact successful completion of training. As emphasized by The Workforce Investment Network’s “Made in Memphis” report and as an identified national best practice, it is recommended that a readiness or preparation program integrate the ACT National Career Readiness Certificate (NCRC) and use of the WorkKeys online WIN system for self-paced remediation. The opportunity exists to utilize Southwest Tennessee Community College’s Industrial Readiness Training (IRT) for this purpose. This could be a natural outgrowth of Mid-South’s memorandum of understanding with Southwest Tennessee Community College.

### **Review of Process Technology Programs at Comparative Institutions**

This analysis also included a review of process technology programs at comparative institutions. This review included both certificate and associate degree programs, located in various regions, and included a number of NAPTA-endorsed institutions. Our analysis found that the majority of

process technology education programs were focused on specific industry sectors. In the case of NAPTA/PTEC programs, the majority of institutions are located in Texas and Louisiana with programs focused on the oil and gas industries.

For those institutions offering accelerated (fast-track) certificate programs in process technology (Laramie County Community College and Delta College), they were designed to be selective admissions programs, requiring minimum ACT WorkKeys scores and/or prior manufacturing experience. A number of institutions (Lewis and Clark, South Arkansas, Joliet) only offered technical certificates or more comprehensive (30+ credit hours) certificates of proficiency to include both technical coursework and core workplace skills training. Brief summaries of comparative programs are provided below.

- *Lewis & Clark Community College (IL)* focuses on oil and gas industries. Lewis and Clark offers two AAS degree programs, one focused on biochemical and the other on petroleum. Its current certificate program in process operations technology consists of 11 NAPTA/PTEC courses (intro to process tech, process tech equipment I & II, safety, health and environment, process instrumentation I & II, process tech operations, process tech systems, quality control, process troubleshooting, and process tech internship). This would be equivalent to Mid-South's Level 1 and Level 2 certificates of proficiency combined.
- *South Arkansas Community College* offers technical certificates and an associate degree in Process Technology. Its technical certificate (33 credit hours, completed in 2 semesters) includes: Intro to Process Tech, EH&S, Process Instrumentation, Process Tech Equipment, Quality, Technical Math, Chemistry; Composition, Computers/Info Processing, and Physical Science. Students can continue their education with two additional semesters (13-15 credit hours each) to earn their associate degree. Coursework includes instrumentation II, process troubleshooting, PTEC systems, technical writing, social science, internship and/or electives.
- *Laramie County Community College (WY)* implemented a pilot program in 2013 for a process technology 11-week accelerated certificate program, in partnership with area refineries. Program modifications were to be made based on industry feedback. Students considering this program must meet the same hiring criteria demanded by industry to be accepted into the program. This includes a background check, drug screen, and completion of a Career Readiness Certificate at the silver level. The certificate program is 17 credit hours, was based on input from industry partners, and includes the following courses: intro to process tech (2 credit hours), EH&S with OSHA (4), electrical and mechanical fundamentals (2 each), process tech equipment and systems (3 each), and principles of quality (1). This accelerated program aligns to Mid-South's originally proposed certificate of proficiency – level 1. Laramie County Community College anticipated offering an Associates of Applied Science degree in 2014 if program demand by employers was sufficient.

- *Joliet Junior College (IL)* offers a process operator program for chemical and other manufacturing industries. It is a comprehensive program covering all aspects of process technology careers and required skills (intro to process tech, process tech duties and responsibilities, technical math, basic physics and math, safety and health, pumps, basic electricity and motors, compressors and turbines, furnaces and heaters, steam systems, valves and actuation, refrigeration, cooling towers, distillation, instrument, P&ID drawings, communication, teamwork and problem solving. The program is structured as a fast-track program and is completed in 15-20 weeks.
- *Delta College (MI)* has a fast start program for chemical process operators/technicians and an Associate Degree in Chemical Process Technology (CPT). The Fast Start (RSN) program is a 480-hour accelerated program (12 week, 40 hours per week). Completers earn up to 25 academic credits toward the CPT Associate Degree. The program is designed for individuals who have minimum ACT WorkKeys scores (Level 5), manufacturing experience, and previous college/training is preferred. This advanced certificate program is appropriate for experienced workers with previous technical degree/experience or for those changing from a career in another manufacturing industry.
- *College of the Mainland (TX)* and *Remington College (AL)* both offer NAPTA-approved associate degrees in process technology. Courses included in the College of the Mainland's associate degree of applied science in process technology include: intro to process tech, process tech equipment, EH&S, instrumentation, quality, PT systems, industrial processes, process troubleshooting, PT operations, as well as related coursework in chemistry, physics, math, English, sociology/psychology, humanities, communications, capstone/operations.
- *Wharton County Junior College (TX)* also offers an associate degree program in Process Technology, focused on the chemical industry, and using NAPTA curriculum as a foundation (intro to process tech, EH&S, PT equipment, instrumentation I & II, quality, PT systems, industrial processes, and process troubleshooting/capstone). In addition, the program requires English composition, applied chemical technology, intro to computing, chemistry, communication, math/algebra, and critical thinking/problem solving.
- *Los Medanos College (CA)* and *Baton Rouge Community College (LA)* both utilize NAPTA/PTEC curriculum and are focused on the chemical and refining industries. Baton Rouge Community College engaged industry and created an associate degree program with selective admissions.



## Competencies and Skills Requirements

### National Skills Certification System

In response to the high percentage of manufacturers reporting hiring issues and the growing national concern for the shortage in skilled workers in manufacturing and trade skills, the National Association of Manufacturers (NAM) and its affiliate, the Manufacturing Institute (MI), launched a major initiative to define and develop skills criteria and standards for a broad range of manufacturing skills (designated as the “Skills Certification System”). The Skills Certification System provides defined standards and certifications in a variety of areas, ranging from basic academic and core manufacturing skills, to occupation specific and advanced skills for defined career pathways. This nationally recognized certification system aligns to the U.S. Department of Labor’s Manufacturing Competency Model (see Appendix 3) that outlines the core competencies required for individuals to enter and advance in a manufacturing career.

A primary purpose of this initiative is to provide focused, nationally recognized credentials that can be used by education institutions in program development that would better address the needs of industry. The program is modularized to enable customization to local needs. Further, broad utilization of the system enhances acceptance and enables the acceleration of training for local and regional workforce segments to create a larger, more productive, skilled labor pool, and enable job seekers to more quickly gain the skills required for employment in high demand occupations. One example of accelerated training is the Rights Skills Now model, which seeks to provide students with the skills and aligned credentials to gain entry level employment, then advance their skills through completion of additional training and achievement of advanced, stackable credentials.

### Why Certifications?

Skills certifications are becoming the “new currency” in the marketplace. Employers are seeking clear ways of determining what workers know and are able to do on the job. Workers are seeking alternatives or add-ons to degrees to demonstrate marketable competencies. Educational systems are looking for efficient ways to provide seamless, effective delivery of programs from high school through four-year institutions. Industry certifications are a win-win proposition. Certifications provide an objective way for:

- Students to validate the talent they can bring to the job;
- Educational providers to establish the value of their product; and
- Employers to have a level of certainty about the skill level of an individual before hiring them.

While third-party certification can be awarded after testing, totally apart from the education process itself, embedding certifications within education pathways benefits the student, the educational provider, and the employer. The Manufacturing Institute has been collecting

documentation on the value of certifications over the past ten years. Some of the major benefits of certifications include:

#### *Benefits for Students*

- Documents knowledge and skills gained through education or life experiences
- Offers a competitive advantage when looking for work or career advancement
- Increases career opportunities and earning potential
- Enhances transferable skills across industries within manufacturing or other sectors

#### *Benefits for Educators*

- Outlines critical foundation and workplace skills employers are demanding
- Identifies technical skill sets employers require, particularly in high growth occupations
- Provides clear guidance for updating/aligning curricula with industry requirements
- Standardizes learning outcomes across similar programs nationally

#### *Benefits for Educational Systems*

- Enhances efficiencies of the education and workforce delivery systems
- Supports sector-based strategies, linking closer to an economic development agenda
- Increases acceptance of credits for articulation across programs and institutions
- Promotes student completion

#### *Benefits for Employers and Communities*

- Access to a skilled workforce they can further develop through on-the-job training
- Ability to focus during the hiring process on the candidate “fit” within the company
- Reduced training costs and turnover, enhanced workplace safety, and increased productivity
- Improved quality of the workforce and workforce expertise in a community or region

Additional information on the National Skills Certification System is available at the website: [www.nam.org](http://www.nam.org) (click on “Manufacturing Institute, Skills Certification”) or at: [www.themanufacturinginstitute.org/Skills-Certification/Skills-Certification-System.aspx](http://www.themanufacturinginstitute.org/Skills-Certification/Skills-Certification-System.aspx).

#### **MSSC, ASQ, and ISA**

The Manufacturing Institute has defined standards for skills certifications in a variety of technical areas. With regard to process technology, the most relevant standards and certifications are through the Manufacturing Skill Standards Council (MSSC), the International Society of Automation (ISA), and the American Society for Quality (ASQ). An overview of these certifications is provided below. In addition, ACT WorkKeys offers the National Career Readiness Certificate (NCRC) which validates core academic competencies including reading for information, applied math, and locating information. As previously discussed, it is recommended that WorkKeys be utilized either as a prerequisite for program entrance or

integrated into the certificate of proficiency program allowing students to remediate skills to earn a level 4 (silver) WorkKeys Certification as they are completing the level 1 certificate of proficiency.

#### Manufacturing Skill Standards Council (MSSC)

The standards for the Certified Production Technician (CPT) are established through industry guidance and the Manufacturing Skill Standards Council (MSSC). To earn the CPT credential, students must successfully pass four separate assessments including Manufacturing Processes and Production, Safety and Teamwork, Quality, and Maintenance Awareness. Students can earn individual certifications for each of these topics or the full CPT designation. Additional information can be found at [www.msscusa.org](http://www.msscusa.org).

As outlined in Appendix 4 (Process Technology Competency and Credential Crosswalk), key competencies for the NAPTA PTEC curriculum and MSSC Safety certification were compared for alignment. Based on this comparison, the PTEC curriculum being utilized by Mid-South is inclusive of almost all key competencies for the MSSC Safety certification. As such, it is recommended that Mid-South consider use of the MSSC Safety assessment to not only allow students to earn credentials while completing the process technology program, but also to evaluate and validate program content to industry standards. As noted in Appendix 4, safety (and related MSSC content) is primarily included in PTEC's quality and health, safety and environment courses. As PTEC curriculum is heavily focused on process operations, there was limited alignment to the other three MSSC CPT assessments (quality, maintenance, and manufacturing processes and production).

It is suggested that the created competency list (Appendix 4) and/or competency category list (Appendix 5) can be utilized with the process technology advisory council to review and prioritize desired (or required) entry level employment skills. Based on feedback from regional employers on the specific process technology positions and related skill requirements (as per previous discussion on target occupations), Mid-South may find that integration of the MSSC CPT program would enhance employment opportunities for students and better meet the needs of regional business and industry. It is further recommended that as curriculum is developed in the areas of quality, maintenance, and manufacturing processes, the competencies included in the MSSC CPT program be fully integrated. This will allow students to not only complete a credit-bearing course (or group of courses), but also earn an MSSC credential. For example, the process technician courses related to mechanical and electrical fundamentals could be designed around the MSSC maintenance awareness course.

#### American Society for Quality (ASQ)

The American Society for Quality established guidelines and training programs to develop and enhance skills and practices related to the achievement of superior quality in products and processes. In addition, ASQ offers a variety of assessments/credentials to validate knowledge and skill of quality professionals. ASQ credentials range from entry-level to advanced, with varying levels of education and/or experience requirements. ASQ offers two entry level credentials that would be relevant to recent process technology and quality program graduates



(associate degree or two years of equivalent higher education) that validate knowledge of quality tools and processes. This includes the Certified Quality Process Analyst and the Certified Quality Inspector. Additional information can be found at [www.asq.org](http://www.asq.org).

The process technology competency and credential crosswalk (Appendix 4) also includes a comparison of the PTEC curriculum to the ASQ Certified Quality Process Analyst (CQPA) credential. Although there were many points of similarity (teamwork, customer expectations, understanding systems and processes, documentation, continuous improvement, cost of quality/economics, process improvement, control charts/SPC, problem solving, preventive/corrective action, and process capability), there were also points of departure. To adequately prepare students to earn the ASQ CQPA, Mid-South would need to review the content of their quality courses to ensure adequate coverage of the CQPA body of knowledge. For example, the PTEC curriculum appears to be missing the following CQPA competencies: selecting/testing materials, production planning and workflow, inventory/product costs, just-in-time and push/pull production, basic measurements, ISO9000 standards and quality systems, and quality auditing/inspections). In addition, the depth of PTEC coverage for some of the key ASQ competencies appears to be insufficient to prepare individuals to attain their ASQ certification.

Once again, emphasis on the ASQ certification will be dependent on the needs of regional employers, specifically the highest demand process technology positions, the assigned job tasks for these positions, and the minimum requirements or desired skills/credentials for employment and advancement. Integration of ASQ CQPA curriculum into Mid-South's quality courses or the addition of a "stand-alone" CQPA prep course would be recommended. This may also serve to increase enrollment as incumbent workers seek training to earn credentials and advance their careers. Also, as the eligibility for the CQPA requires two years of education and/or experience, including the CQPA credential at the Associate Degree level would be recommended. This would enable individuals with limited prior experience to earn their ASQ certification at time of graduation.

#### International Society for Automation (ISA)

ISA is a leading global, non-profit organization that is setting the standard for automation. ISA develops standards, certifies industry professionals, provides education and training, publishes books and technical articles, and hosts the largest conference in the Western Hemisphere. The primary ISA certification is the Certified Control Systems Technician (CCST) which focuses on 4 key domains: (1) Calibration, Maintenance, Repair, Troubleshooting, (2) Project Start-up, Commissioning, Loop-check, Project Organization, Planning, (3) Documentation, and (4) Administration, Supervision, Management. The ISA CCST focuses on instruments and devices, and can be earned at three progressive levels, with level 1 emphasizing domain 1 but also including tasks in domains 2 and 3; and level 3 CCST emphasizing domain 4, but also including all other domain tasks.

Additional information on ISA and the CCST can be found at [www.isa.org](http://www.isa.org).

To be eligible to earn the ISA CCST individuals must have a five-year total of education, training, and/or experience. The following elements may be used to satisfy this requirement: (a) a registered apprenticeship in an instrumentation, measurement and control, electronics, electrical, and/or mechanical program, (b) an academic degree (or equivalent) in a related technology area (maximum of four years), (c) successfully completing the CST Associate Recognition Program (a maximum of one year), and/or (d) a minimum of one year related work experience. See more at: <https://www.isa.org/training-and-certifications/isa-certification/ccst/ccst-requirements/#sthash.GaTqwNMf.dpuf>.

Due to the education/experience requirement for the CCST, this credential would be most appropriate for incumbent workers who are completing PTEC courses to expand their skills and for prior program graduates who have gained relevant work experience and seek to validate their skills and advance their careers.

As outlined in Appendix 4, the CCST credential aligns very well to the NAPTA PTEC curriculum. Core competencies included in the CCST and also covered in the PTEC curriculum include: Systems and Processes, Documentation, Process Control Instrumentation, Process Variables and Measurements, and Process Control Operations. To improve alignment of the CCST to Mid-South's process technology programs, content would need to be added in the areas of precision measurement tools, audits/inspections, and instrument calibration.

At the entry level, Mid-South should strongly consider implementation of the ISA Control System Technician (CST) Associate program. An ISA CST Associate will have specialized work experience and/or an educational background in instrumentation and control or a related field and be able to successfully complete an ISA examination. A CST Associate must meet specific criteria based on educational courses or work experience in automation and control, electrical/electronics, or mechanical technologies. One of the following backgrounds will satisfy this requirement:

- Successfully completed 16 semester course hours (or 24 quarter hours) from an educational institution within the related technology areas (courses in basic science, mathematics, social science, humanities, and communications will not count towards the requirement);
- Successfully completed a two-year academic degree in a related technology area; or
- Two years of work experience in a related technology area with a minimum of a high school diploma.

Although the CST Associate program is not a certification, it does require successful completion of an examination that is designed to measure a fundamental understanding of knowledge in instrumentation and control. It recognizes an individuals' commitment to a career in automation and control and shows that their educational accomplishments are only the beginning.

Completing a certificate of proficiency in process technology and earning the CST Associate recognition would enable individuals to begin their process technology career with two (of five)

years education/experience required for the Certified Control Systems Technician (CCST) credential. Additional information on the CST Associate Recognition Program can be found at: <https://www.isa.org//training-and-certifications/isa-certification/ccst/ccst-associate-recognition-program/>.

### **Process Technology Career Pathways**

The primary goal of this grant project was to develop articulated education pathways that deliver competency-based, stacked, and latticed credentials. The U.S. Department of Labor and the Alliance for Quality Career Pathways define a stackable credential as “part of a sequence of credentials that can be accumulated over time to build individuals’ qualifications and help them move along a career pathway up a career ladder to different and potentially higher paying jobs” (AQCP, p.11). Stackable credentials that are part of a quality career pathway system should be informed by labor market information and demonstrate evidence that they are valuable to employers and participants.

Provided on the next page is a tentative education and career pathway for Process Technology as proposed/offered by Mid-South Community College. Once certificate programs are finalized, the pathway can be updated and utilized for outreach and recruitment purposes. It is also important to note that successful career pathways are comprised on more than just training, credentials, and aligned occupations.

Essential features of quality career pathways include:

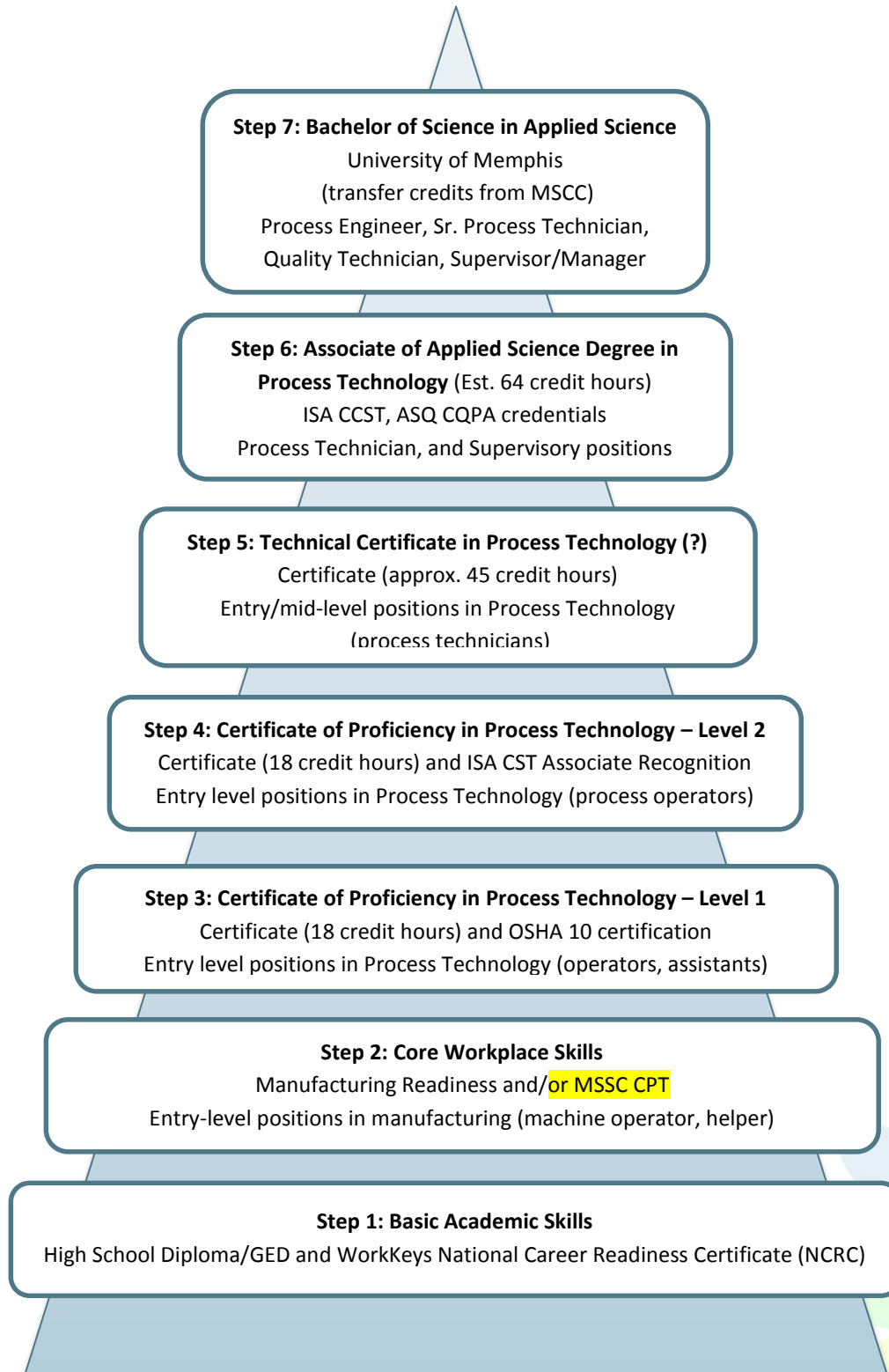
- Well-connected and transparent education, training, credentialing, and support service offerings (often delivered via multiple linked and aligned programs);
- Multiple entry points that enable well-prepared students as well as targeted populations with limited education, skills, English, and work experience to successfully enter the career pathway; and
- Multiple exit points at successively higher levels leading to self- or family-supporting employment and aligned with subsequent entry points.

Essential functions in quality career pathways and programs include:

- Participant-focused education and training;
- Consistent and non-duplicative assessments of participations’ education, skills, and needs;
- Support services and career navigation assistance to facilitate transitions; and
- Employment services and work experiences.

Additional information of creating high quality career pathways can be obtained through the Alliance for Quality Career Pathways (a project of CLASP) at: <http://www.clasp.org/issues/postsecondary/pages/aqcp-framework-version-1-0>.

**Mid-South Community College Process Technology Education and Career Pathway**



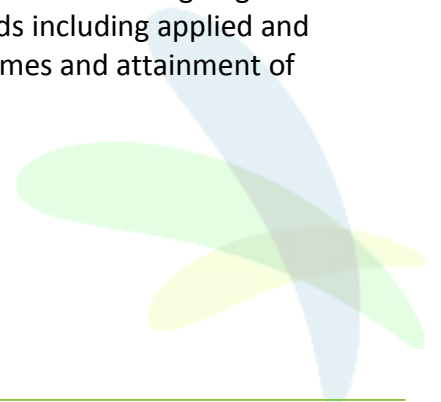
## Summary and Recommendations

In an effort to meet the needs of regional business and industry, Mid-South Community College is in process of developing a process technology program that will consist of a series of stackable certificates and culminating with an associate degree. Curriculum is being developed utilizing resources and standards from NAPTA.

A Process Technology Employer Forum was held in October 2014 wherein demand for skilled workers was confirmed and preliminary data was gathered on regional hiring requirements. Further engagement with regional employers, through use of a Process Technology Advisory Council, is recommended to (a) identify the various process technology positions needed by industry, (b) clarify the level of demand for these positions, (c) identify the key duties and responsibilities for entry-level positions, and (d) verify and prioritize the specific competencies (knowledge and skills) required (or desired) for employment. This information will enable Mid-South to further customize course content to meet industry identified outcomes, and ensure that appropriate courses are included within each certificate program.

Mid-South will also be well-served to further explore minimum hiring requirements and hiring processes to ensure that students are prepared for entry-level employment. For example, if regional employers conduct pre-employment assessments in basic math skills, Mid-South will need to include contextualized math instruction and/or establish appropriate prerequisites, such as the National Career Readiness Certificate. As the level 2 Certificate of Proficiency includes a process technology internship, engagement with employers will also serve as a means to establish partnerships to increase experiential learning opportunities and structured internships for students.

Once specific occupational skill needs are identified by employers, Mid-South would review and modify program curriculum as appropriate. In addition, industry-recognized credentials should be integrated to the greatest extent possible to validate skill attainment, increase employment opportunities for students, and enhance the quality and value of Mid-South academic programs. Priority emphasis should be placed on ISA's CST Associate program and ASQ's Certified Quality Process Analyst (CQPA). Utilizing third-party certifications also provides the opportunity to evaluate academic programs and validate the achievement of student outcomes. In general, the process technology courses should be evaluated on an ongoing basis for the purpose of modifying course content, refining teaching methods including applied and experiential learning, and improving the assessment of learning outcomes and attainment of skills.



## Appendix 1: Greater Memphis Process Technology Employer Forum (Summary and Results)

### 1. Forum Overview

- The Greater Memphis Chamber (Dexter Muller) provided an overview of the challenges faced in the region as a result of the manufacturing skills gap, and highlighted the significant opportunities currently available to address this issue.
- Mid-South Community College (Pete Selden) discussed their recent federal grants and the development of certificate and associate degree programs for Process Technology, aligned to NAPTA (North American Process Technology Alliance) curriculum and standards.
- Southwest Tennessee Community College (John Churchill) highlighted the work done to-date with their Industrial Readiness Training (IRT) program, the collaborative efforts of the Workforce Development Institute, and new funding for sector-based workforce alliances.

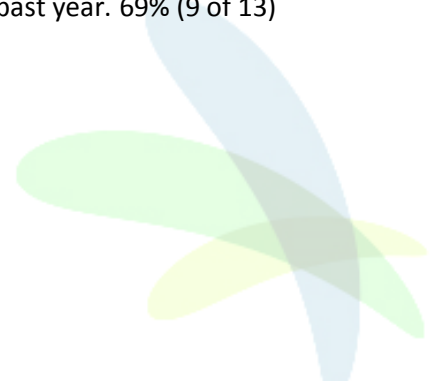
### 2. Manufacturing Skills Gap

- The Manufacturing Institute (Brent Weil, Lisa Goetsch) discussed the manufacturing skills gap from a national perspective highlighting the importance of public-private partnerships and providing a variety of examples of successful initiatives. Goals for the partnership would include: changing the perception of careers in manufacturing, re-establishing the U.S. as the global leader of manufacturing education through use of a national skills certification system, and advocating for education and job training policies that strengthen the U.S. manufacturing workforce.
- The Manufacturing Institute also detailed the process for building a regional talent pipeline through the creation of occupational career pathways that are aligned to industry recognized credentials that meet manufacturers' skill requirements. To implement this business-led, collaborative approach, the region would need to quantify current and future demand for process technicians, clarify positions in greatest demand, and determine minimum skill requirements for hiring. Forum attendees provided input on some of these issues with results noted below.

### 3. Process Technology Needs / Survey Results

- To verify the challenge of finding skilled process technicians, forum participants were asked if they had difficulty recruiting/hiring process technicians in the past year. 69% (9 of 13) noted it was difficult or very difficult.

<i>Difficulty Hiring</i>	<b>Responses (13)</b>	
	Percent	Count
Not at all Difficult	0.00%	0
Somewhat Difficult	30.77%	4
Difficult	23.08%	3
Very Difficult	46.15%	6



- To quantify the level of demand, participants were asked about current employment levels, annual hiring needs, and projected future demand – for Process Technicians. Although 4 manufacturers do not currently have any Process Tech employees, the overwhelming majority employ 16 or more, indicating a minimum of 175 Process Tech employees among the participant companies.

<i>Current employees</i>	<b>Responses (16)</b>	
	Percent	Count
None (0)	25.00%	4
1-3	0.00%	0
4-6	6.25%	1
7-10	6.25%	1
11-15	0.00%	0
16+	62.50%	10

- Annual hiring needs were diverse, with a minimum of 80 open Process technician positions each year (on average).

<i>Annual Hiring Needs</i>	<b>Responses (14)</b>	
	Percent	Count
0-1	21.43%	3
2-4	21.43%	3
5-7	21.43%	3
8-10	0.00%	0
11-15	21.43%	3
16+	14.29%	2

- The majority (80%) of manufacturing participants also noted that demand for Process Technicians would increase in the future.

<i>Demand levels</i>	<b>Responses (15)</b>	
	Percent	Count
Increase Significantly	33.33%	5
Increase Slightly	46.67%	7
Remain the Same	20.00%	3
Decrease Slightly	0.00%	0
Decrease Significantly	0.00%	0

- Discussion was also held on the “Made in Memphis” report (April 2013) and the need to further clarify and gather accurate data on Process Technician positions. Job titles and duties of PT positions vary among industry sectors and may be focused on operations, quality, I&E (Instrumentation and electronics), or maintenance (mechatronics). Further discussion on PT positions and assigned duties will be needed to confirm regional needs.

- Briefly discussed the primary methods of hiring used by manufacturers, for the purpose of better understanding the level of skill required and the availability of internal advancement opportunities. Responses indicated diverse methods are used. It was also noted that there is significant opportunity for manufacturers to better utilize educational institutions as a source of hiring as nationally these methods are significantly under-utilized (less than 8% of new employees are recruited through colleges and tech schools).

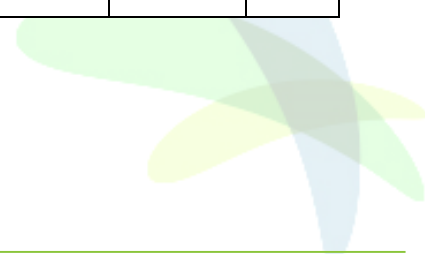
<i>Primary Hiring Method</i>	<b>Responses (9)</b>	
	<b>Percent</b>	<b>Count</b>
Selection / Advancement of Current Employees	22.22%	2
External Hire – Entry Level (partially qualified)	22.22%	2
External Hire – Fully Qualified	11.11%	1
No Primary Method – Use all of the above	44.44%	4

- Manufacturers were asked about their minimum education requirements for hiring process technicians, with the majority noting a high school diploma, a smaller percentage requiring some technical training, one company requiring a bachelor’s degree, and no companies currently requiring a college certificate or associate degree. As this question related to “Minimum” education requirements, it is strongly suggested that further information be gathered with regard to “Preferred” education requirements.

<i>Education Requirements</i>	<b>Responses (13)</b>	
	<b>Percent</b>	<b>Count</b>
High School Diploma	61.54%	8
Some Technical Training	30.77%	4
College Certificate	0.00%	0
Associate Degree	0.00%	0
Bachelor’s Degree	7.69%	1

- Manufacturers were also asked about minimum experience requirements. A range of responses were received with half of the companies requiring 1-3 years of experience. This area of inquiry provides the greatest opportunity for further discussion with regard to the use of internships, hands-on & simulated training, credentials, and college certificate/degree programs to verify that employment candidates possess the skills needed by manufacturers that would otherwise be gained through work experience.

<i>Experience Requirements</i>	<b>Responses (14)</b>	
	<b>Percent</b>	<b>Count</b>
0-1 year	21.43%	3
1-3 years	50.00%	7
4-5 years	21.43%	3
5+ years	7.14%	1





#### 4. Forum Results and Summary

- The forum was well-attended and received. 14 participants completed a meeting evaluation with the majority agreeing (57%) or strongly agreeing (36%) that the forum agenda and topics of discussion were relevant and timely (1 participant was neutral). All participants felt the forum was informative and held their interest (50% agreed / 50% strongly agreed), and the majority agreed (50%) or strongly agreed (36%) that the forum met their expectations (2 participants were neutral).
- Seven of the manufacturers expressed interest in participating on a regional process technician advisory council, 12 (of 14) wanted to receive updates on regional educational programs related to manufacturing, and 7 were interested in further exploring and learning more about the NAM-endorsed skills credentialing system.
- There were also comments related to better engaging youth and high school guidance counselors in these efforts. Opportunities exist for implementing and/or expanding regional and national best practices to improve the image of manufacturing and generate more awareness and interest in manufacturing careers. For example, the Regional Chamber is involved with the Memphis Metropolitan P-16 Council which could play a role, and the region could expand their participation in Manufacturing Day activities.
- How do we create skilled workers to meet regional industry needs?
  - Work Collaboratively. Create a Public-Private partnership for manufacturers, educators, and related stakeholders – with a vested interest in creating a pipeline of skilled process technicians to meet industry needs.
  - As Process Technology positions cross multiple manufacturing sectors, it is recommended that a separate committee be established to continue this discussion.
  - As regional community colleges have received federal grant funding and are in process of developing training/education programs for process technology, it is essential that employers become engaged to ensure training is aligned to hiring and skill requirements, and to better understand the value of credentials in the hiring and advancement process.



## Appendix 2: Process Technology Occupations (Job Tasks, Knowledge and Skill Requirements)

**Chemical Plant and System Operators** (51-8091). Reported Job Titles: Operator, Chemical Operator, Process Technician, Process Operator, Operations Technician, Process Development Technician, etc.

### Tasks:

- Move control settings to make necessary adjustments on equipment units affecting speeds of chemical reactions, quality, or yields.
- Monitor recording instruments, flowmeters, panel lights, or other indicators and listen for warning signals, to verify conformity of process conditions.
- Control or operate chemical processes or systems of machines, using panelboards, control boards, or semi-automatic equipment.
- Record operating data, such as process conditions, test results, or instrument readings.
- Confer with technical and supervisory personnel to report or resolve conditions affecting safety, efficiency, or product quality.
- Draw samples of products and conduct quality control tests to monitor processing and to ensure that standards are met.
- Regulate or shut down equipment during emergency situations, as directed by supervisory personnel.
- Start pumps to wash and rinse reactor vessels, to exhaust gases or vapors, to regulate the flow of oil, steam, air, or perfume to towers, or to add products to converter or blending vessels.
- Interpret chemical reactions visible through sight glasses or on television monitors and review laboratory test reports for process adjustments.
- Patrol work areas to ensure that solutions in tanks or troughs are not in danger of overflowing.

### Knowledge:

- Production and Processing — Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.
- Mechanical — Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
- Chemistry — Knowledge of the chemical composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods.
- Computers and Electronics — Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.

- Public Safety and Security — Knowledge of relevant equipment, policies, procedures, and strategies to promote effective local, state, or national security operations for the protection of people, data, property, and institutions.
- Mathematics — Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- Education and Training — Knowledge of principles and methods for curriculum and training design, teaching and instruction for individuals and groups, and the measurement of training effects.
- Law and Government — Knowledge of laws, legal codes, court procedures, precedents, government regulations, executive orders, agency rules, and the democratic political process.
- Administration and Management — Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.

### Skills

- Operation Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.
- Operation and Control — Controlling operations of equipment or systems.
- Monitoring — Monitoring/Assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action.
- Quality Control Analysis — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
- Critical Thinking — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
- Active Listening — Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
- Judgment and Decision Making — Considering the relative costs and benefits of potential actions to choose the most appropriate one.
- Reading Comprehension — Understanding written sentences and paragraphs in work related documents.
- Writing — Communicating effectively in writing as appropriate for the needs of the audience.
- Active Learning — Understanding the implications of new information for both current and future problem-solving and decision-making.



**Petroleum Pump System Operators, Refinery Operators, and Gaugers** (51-8093)

Tasks

- Monitor process indicators, instruments, gauges, and meters to detect and report any possible problems.
- Start pumps and open valves or use automated equipment to regulate the flow of oil in pipelines and into and out of tanks.
- Control or operate manifold and pumping systems to circulate liquids through a petroleum refinery.
- Operate control panels to coordinate and regulate process variables such as temperature and pressure, and to direct product flow rate, according to process schedules.
- Signal other workers by telephone or radio to operate pumps, open and close valves, and check temperatures.
- Verify that incoming and outgoing products are moving through the correct meters, and that meters are working properly.
- Read automatic gauges at specified intervals to determine the flow rate of oil into or from tanks, and the amount of oil in tanks.
- Operate auxiliary equipment and control multiple processing units during distilling or treating operations, moving controls that regulate valves, pumps, compressors, and auxiliary equipment.
- Plan movement of products through lines to processing, storage, and shipping units, using knowledge of system interconnections and capacities.
- Read and analyze specifications, schedules, logs, test results, and laboratory recommendations to determine how to set equipment controls to produce the required qualities and quantities of products.

Knowledge

- Mechanical — Knowledge of machines and tools, including their designs, uses, repair, and maintenance.
- Mathematics — Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- Public Safety and Security — Knowledge of relevant equipment, policies, procedures, and strategies to promote effective local, state, or national security operations for the protection of people, data, property, and institutions.

Skills

- Operation Monitoring — Watching gauges, dials, or other indicators to make sure a machine is working properly.

- Monitoring — Monitoring/Assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action.
- Operation and Control — Controlling operations of equipment or systems.
- Reading Comprehension — Understanding written sentences and paragraphs in work related documents.
- Complex Problem Solving — Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
- Critical Thinking — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
- Quality Control Analysis — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
- Writing — Communicating effectively in writing as appropriate for the needs of the audience.
- Judgment and Decision Making — Considering the relative costs and benefits of potential actions to choose the most appropriate one.
- Active Learning — Understanding the implications of new information for both current and future problem-solving and decision-making.

### **Biofuels Processing Technicians (51-8099.01)**

#### Tasks

- Calculate, measure, load, or mix refined feedstock used in biofuels production.
- Operate chemical processing equipment for the production of biofuels.
- Operate equipment, such as a centrifuge, to extract biofuels products and secondary by-products or reusable fractions.
- Operate valves, pumps, engines, or generators to control and adjust biofuels production.
- Process refined feedstock with additives in fermentation or reaction process vessels.
- Assess the quality of biofuels additives for reprocessing.
- Calibrate liquid flow devices and meters including fuel, chemical, and water meters.
- Collect biofuels samples and perform routine laboratory tests or analyses to assess biofuels quality.
- Inspect biofuels plant or processing equipment regularly, recording or reporting damage and mechanical problems.
- Measure and monitor raw biofuels feedstock.

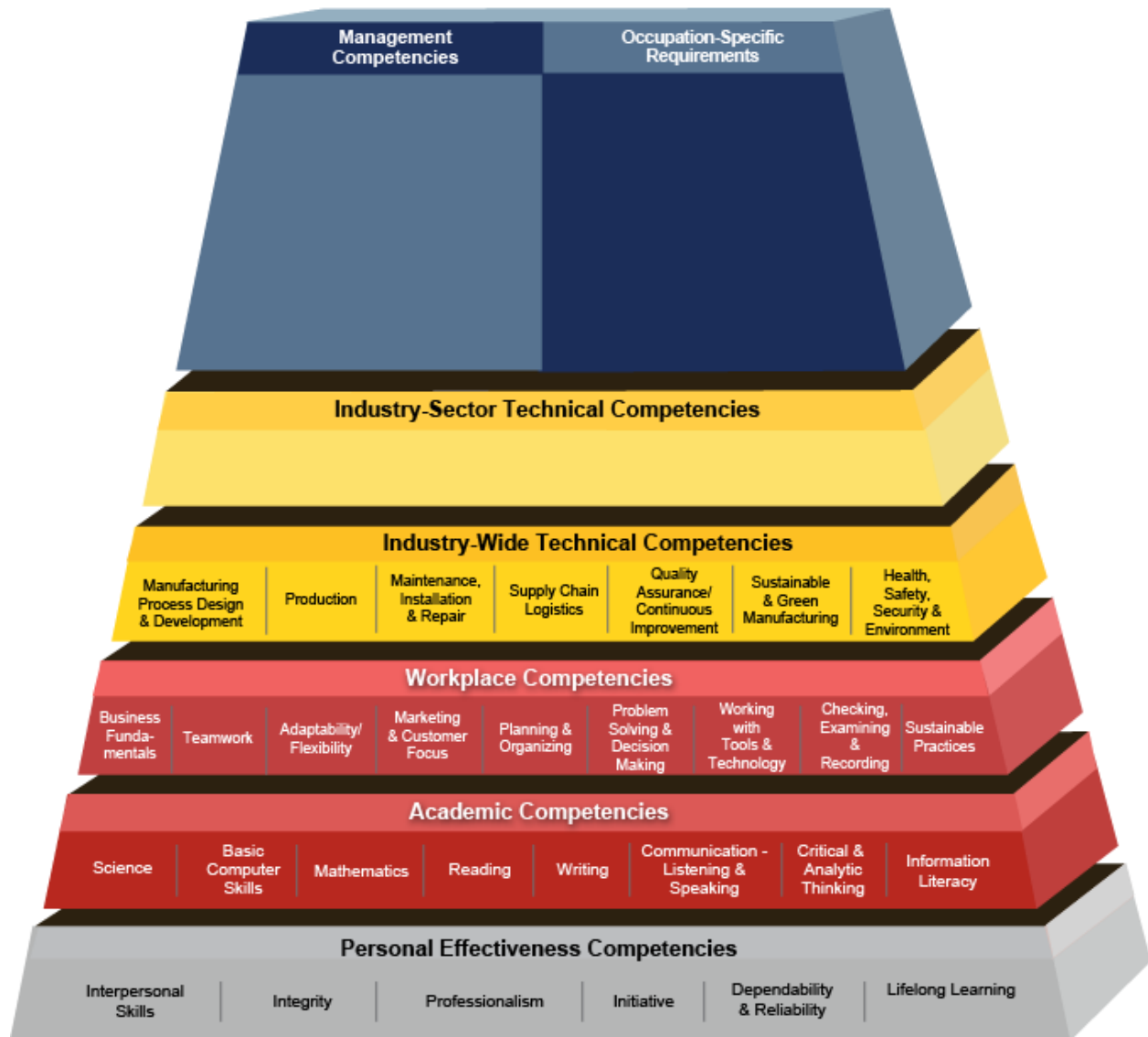
**Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders (51-9012.00)**

Tasks

- Set up or adjust machine controls to regulate conditions such as material flow, temperature, or pressure.
- Monitor material flow or instruments such as temperature or pressure gauges, indicators, or meters to ensure optimal processing conditions.
- Start agitators, shakers, conveyors, pumps, or centrifuge machines, then turn valves or move controls to admit, drain, separate, filter, clarify, mix, or transfer materials.
- Examine samples visually or by hand to verify qualities such as clarity, cleanliness, consistency, dryness, and texture.
- Collect samples of materials or products for laboratory analysis.
- Maintain logs of instrument readings, test results, and shift production, and send production information to computer databases.
- Test samples to determine viscosity, acidity, specific gravity, or degree of concentration, using test equipment such as viscometers, pH meters, or hydrometers.
- Measure or weigh materials to be refined, mixed, transferred, stored, or otherwise processed.
- Clean or sterilize tanks, screens, inflow pipes, production areas, or equipment, using hoses, brushes, scrapers, or chemical solutions.
- Inspect machines or equipment for hazards, operating efficiency, malfunctions, wear, or leaks.



## Appendix 3: Manufacturing Competency Model - U.S. Department of Labor



## Appendix 4: Process Technology Competency & Credential Crosswalk

	MSSC CPT				ISA CCST	ASQ CQPA	PTEC / CAPT							
	P	Q	M	S			PT	S	Q	E	SY&O	I		
Manufacturing (PT*) Careers				X			X*							
Communication Skills				X					X					
Teamwork				X		X	X		X					
Personal Effectiveness									X					
Conflict resolution / training				X		X								
Workplace Safety				X			X	X						
Regulatory Agencies				X			X	X						
PPE				X			X	X						
Fire and Electrical Safety				X				X						
Hazardous Materials				X				X						
Tool and Machine Safety				X				X						
Material Handling Safety				X										
Hazards and Hazard Control								X						
Physical & Cyber Security								X						
Customer Expectations/Specs	X			X		X			X					
Types and Methods of Production	X													
Mechanical Principles	X													
Basic Physics and Chemistry								X						
Systems and Processes					X	X			X					
Mechanical Linkages	X													
Production Materials & Chemicals	X													
Testing and Selecting Materials	X					x								
Production Processes	X													
Machining Processes and Operations	X													
Tools and Equipment	X									X				
SOP's, technical manuals	X								X		X			
Production planning and workflow	X						X							
Inventory, product costs	X						X							
JIT and push/pull production	X						X							
Documentation	X				X	X			X					
Policies and Procedures									X					
Product packaging / distribution	X													



## Appendix 4: Continued

	MSSC CPT				ISA CCST	ASQ CQPA	PTEC / CAPT						
	P	Q	M	S			PT	S	Q	E	SY&O	I	
Blueprint Reading / GD & T		X											
Process Diagrams (P&ID, Elec, flow)							X			X			X
Basic Measurement		X				X							
Precision Measurement Tools		X			X								
Dimensional gauging		X											
Quality Systems / ISO9000		X				X							
TQM and Economics/finance						X			X				
Continuous Improvement		X				X			X				
Audits / Inspections		X			x	X							
Quality / Process Improvement		X				X			X				
SPC / Controls Charts		X				X			X				
Root cause analysis / problem solving		X				X			X				
Preventive/Corrective action		X				X			X				
Process Capability						X			X				
Welding			X										
AC/DC Electricity			X										
Motors and Engines							X			X			
Electrical Power and measurements			X										
Fluid Power (Hydraulics/Pneumatics)			X										
Lubrication			X							X			
Bearings and Couplings			X										
Belt and Chain Drives			X										
Machine Control / logic / diagrams			X										X
Machine Automation / Control Systems			X										X
Piping and valves							X			X			
Tanks, Drums, & Vessels							X						
Pumps, Compressors, Steam Turbines							X			X			
Heat Exchangers, Cooling Towers							X			X			
Furnaces, Boilers, Distillation							X			X			
Process Control Instrumentation					X		X						X
Instrument calibration					X								
Process Variables and Measurements					X								X
Process Utilities and Auxiliaries							X						
Process Tech Systems												X	
Operations (start-up, shut-down)					X							X	

## Appendix 5: Process Technology Competency Categories

1. Enter R for any/all categories that are required (education or experience) or P for Preferred in the hiring of entry-level Process Technicians.
2. Rank in priority order with 1 being the most critical competency or skill requirement for your process technician position.

Category of Knowledge/Skill	Required (R) Preferred (P)	Priority / Importance
Manufacturing Processes and Production		
Process Technology Equipment		
Instrumentation and Measurement Devices		
Maintenance (Mechanical)		
Maintenance (Electrical/Electronic)		
Preventive and Predictive Maintenance		
Process Control / SPC / Process Capability		
Quality Practices / Corrective Action		
Process Improvement		
Lean / Efficiency		
Environmental, Health and Safety		
Equipment Operation		
Applied / Technical Math		
Logistics / Distribution		
Sector-Specific Processes and Knowledge (Chemical, Petroleum, etc.)		
Leadership (Communication, Teamwork)		
Physics		
Print Reading, Process Diagrams		
Computers / Automation / Programmable Logic Controllers		
Other:		
Other:		

