ECONOMIC & WORKFORCE DEVELOPMENT
through the CALIFORNIA COMMUNITY COLLEGES

BUSINESS AND WORKFORCE
PERFORMANCE IMPROVEMENT INITIATIVE

Medical Device Industry

Orange County Region
March 2008

Prepared by:

Center of Excellence, Orange County Region
Hosted by Rancho Santiago Community College District
2323 N. Broadway, Suite 328
Santa Ana, CA 92706
Phone: (714) 564-5529 Fax: (714) 796-3924
chamorro_gustavo@rsccd.org
www.cccewd.net

Contents:

BASED ON A 2007 SURVEY OF MEDICAL DEVICE EMPLOYERS IN THE ORANGE COUNTY REGION, IT IS ESTIMATED THAT THE INDUSTRY WILL REQUIRE AN ADDITIONAL 2,400 WORKERS OVER THE NEXT 12 MONTHS. EMPLOYERS SURVEYED ANTICIPATE EMPLOYMENT GROWTH OF 19% OVER THE NEXT YEAR FOR THE OCCUPATIONS IN GREATEST DEMAND. SOURCE: BW RESEARCH PARTNERSHIP

Executive Summary

The medical devices industry is a significant and growing industry in the Orange County region. With increasing employment opportunities, excellent wages and a defined career path for advancement, the industry's growth presents strong opportunities for community colleges to build upon their existing Contract Education programs, and for Career Counseling programs to increase student awareness about opportunities in the industry.

Medical devices cover a wide range of health or medical instruments used in the treatment, mitigation, diagnosis or prevention of diseases or abnormal conditions.[1]
Product examples include:

- Stents, pacemakers and other implantable devices
- Bioimaging and advanced imaging equipment
- Orthopedic and prosthetic implants and devices
- Dental instruments and orthodontics
- Laser eye surgery equipment and ophthalmic goods

A number of factors led the Centers of Excellence to study the medical device industry:

- The industry is concentrated in California and has a large concentration in Orange County.
- The industry is growing – mainly due to the changing health care needs of an increasingly aging population.
- Advances in manufacturing technologies that enable smaller, more sophisticated devices to be produced are also fueling industry growth.
- The infusion of large amounts of venture capital to medical device firms indicates the heightened importance of the industry for investment purposes.

A central feature of this report is the release of original research on the medical device industry conducted for the Centers of Excellence by BW Research Partnership[2], a recognized leader in labor market research. Approximately 70%

[1] Food and Drug Administration, definition of medical devices.
[2] BW Research Partnership, Josh Williams, Principal Researcher, (760) 730-9329, www.bwresearch.com

of employers surveyed for this report indicated difficulty in recruiting employees with appropriate education and training. 60% of employers surveyed expressed interest in a medical device Associate's Degree for working technicians to become managers, while more than 50% expressed interest in on-site customized training for current employees. All eight of the occupations outlined in this report require no more than an associate degree and are technician-level jobs.

This report provides an overview of the industry, identifies industry workforce and training needs, summarizes the key research findings and recommends possible college responses.

Introduction

The California Community Colleges System has charged the Centers of Excellence, one of the ten initiatives of the Economic & Workforce Development (EWD) Network, with identifying industries and occupations with unmet employee development needs and partnering potential for the colleges' programs.

In this report, we cover the Medical Device Industry (MDI). In 2006, the Medical Device Industry employed 100,459 individuals in the state of California, of which 17,633 worked in Orange County. Due to factors such as an aging population and advances in medical technology, the Medical Device Industry is predicted to grow significantly over the next few years; thus providing more job opportunities locally and statewide.

Industry Overview

The medical devices industry can be viewed as a composite cluster directly impacted by advanced manufacturing, biotechnology, and the healthcare industry. Firms in this industry produce biomedical instruments and other health care products and supplies for diagnostics, surgery, patient care and clinical laboratories.

The following North American Industry Classification System codes (NAICS) are associated with the Medical Device Industry:

NAICS Code	Medical Device Industry Sub-Sectors
334510	Electro Medical/Electro-therapeutic Apparatus Manufacturing
334516	Analytical Laboratory Instrument Manufacturing
334517	Irradiation Apparatus Manufacturing
339111	Laboratory Apparatus and Furniture Manufacturing

339112	Surgical and Medical Instrument Manufacturing
339113	Surgical Appliances and Supplies Manufacturing
339114	Dental Equipment and Supplies Manufacturing
339115	Ophthalmic Goods Manufacturing
339116	Dental Laboratories
621511	Medical Laboratories
621512	Diagnostic Imaging Centers
327215	Glass Product Manufacturing

Each of these twelve (12) six-digit NAICS codes that define the medical devices industry can be classified into one of three sectors: biotechnology support (NAICS 327215, 334510, 334516, 33517), advanced manufacturing (NAICS 339111-339116), and medical and diagnostic laboratories (NAICS 621511, 621512).

Individual NAICS codes with the highest percentages of growth in Orange County were:

- NAICS 339116: Dental Laboratories: 208.6% growth, 1,963 jobs
- NAICS 621512: Diagnostic Imaging Centers: 107.9% growth, 561 jobs
- NAICS 621511: Medical Laboratories: 36.6% growth, 1053 jobs

Comparatively, the following individual NAICS codes experienced employment declines over the ten year period from 1996 to 2006:

- NAICS 327215: Purchased Glass Product Manufacturing: -46.5% growth, -121 jobs
- NAICS 334510: Electromedical Apparatus Manufacturing: -32.8% growth, -788 jobs
- NAICS 339113: Surgical Appliance and Supplies Manufacturing: -16.6% growth, -431 jobs.

The following table provides employment numbers by sector[3]:

Table 1: State and Orange County Medical Device Industry employment by Sector

	California				Orange County			
	Annual Average Employment		Employment Change		Annual Average Employment		Employment Change	
	1996	2006	Numerical	Percent	1996	2006	Numerical	Percent
Biotechnology Support	**27,083**	**28,090**	**1,007**	**3.7%**	**5,227**	**4,355**	**-872**	**-16.7%**
Purchased Glass Product Mfg	5,038	4,036	-1,002	-19.9%	260	139	-121	-46.5%
Electromedical Apparatus Mfg	12,078	12,044	-34	-0.3%	2,403	1,615	-788	-32.8%
Analytical Laboratory Instruments	9,157	11,002	1,845	20.1%	2,564	2,566	2	0.1%
Irradiation Apparatus Manufacturing	810	1,008	198	24.4%	0	35	35	N/A
Advanced Manufacturing	**43,443**	**48,019**	**4,576**	**10.5%**	**9,045**	**10,830**	**1,785**	**19.7%**
Laboratory Apparatus and Furniture	620	1,248	628	101.3%	0	62	62	N/A
Surgical and Medical Instrument Mfg	15,877	19,854	3,977	25.0%	3,535	3,424	-111	-3.1%
Surgical Appliance and Supplies Mfg	10,721	10,327	-394	-3.7%	2,600	2,169	-431	-16.6%
Dental Equipment and Supplies Mfg	4,327	3,940	-387	-8.9%	0	975	975	N/A
Ophthalmic Goods Manufacturing	6,222	4,004	-2,218	-35.6%	1,033	1,296	263	25.5%
Dental Laboratories	5,676	8,646	2,970	52.3%	941	2,904	1,963	208.6%
Unaccounted on 6-digit level	*0*	*0*			*936*	*0*		
Medical & Diagnostic Laboratories	**17,926**	**24,350**	**6,424**	**35.8%**	**3,400**	**5,014**	**1,614**	**47.5%**
Medical Laboratories	15,223	18,081	2,858	18.8%	2,880	3,933	1,053	36.6%
Diagnostic Imaging Centers	2,703	6,269	3,566	131.9%	520	1,081	561	107.9%
Statewide Medical Device Industry	**88,452**	**100,459**	**12,007**	**13.6%**	**17,672**	**20,199**	**2,527**	**14.3%**

Over the ten year period from 1996 to 2006, medical device industry employment within Orange County increased by 20.7 percent, resulting in over 3,400 new jobs. Overall, the highest percentage of growth was in the medical and diagnostic laboratories sector (47.5% growth; 1,614 new jobs), followed by advanced manufacturing (19.7% growth; 1,785 new jobs), while the biotechnology support sector experienced a decline (16.7% decline; 872 lost jobs).

Forces of Growth

The demographic change influencing the industry is the nation's aging population. According to the U.S. Census Bureau, there will be 54 million people 65 and older by 2020 and more than 86 million people over 65 by 2050.[4] As baby boomers live longer, more sophisticated and longer-term health care is required. The changing health care needs of this population and the accompanying shift by health care providers regarding treatment approaches for people over 65 are driving the growth of the industry. This has created demand

[3] EDD Labor Market Information: www.labormarketinfo.edd.ca.gov
[4] U.S. Census Bureau, "Projected Population of the United States, by Age and Sex, 2000 to 2050"

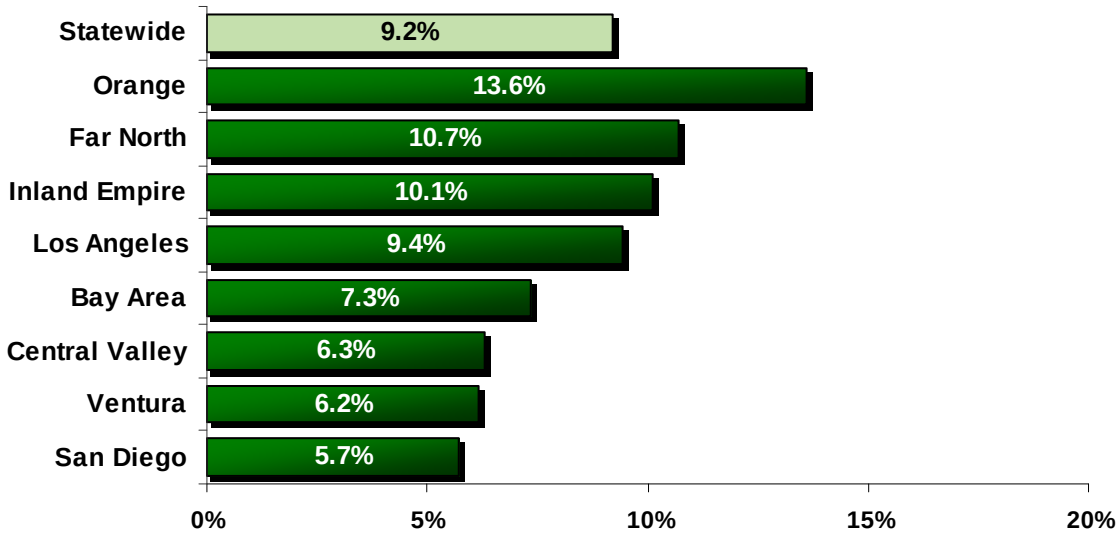
for advanced medical devices and raised expectations that new technologies will enhance the quality and length of patients' lives.[5]

New advanced manufacturing technologies, such as automation, rapid prototyping, photonics (e.g. laser, UV), advanced machining and nanotechnology are also driving growth in the industry. As these new technologies become more integrated into device manufacturing processes, the sophistication of devices accelerates, thus opening up new clinical applications and fueling industry growth. Venture capital firms see these new advances in manufacturing technologies and medical devices as an opportunity to displace and/or augment conventional drug therapies.

This potential opportunity has opened the door to significant venture capital investment in medical device companies. According to Yahoo Finance, "Strong interest in energy, biotech and medical device companies helped push venture capital investment in 2007 to $29.4 billion dollars, up 11% from the year before and the highest level since 2001".[6] Medical devices alone saw a jump in capital investment of 40% from 2006 at $3.9 billion dollars, which was also an increase of 78% from 2005.

The economic and demographic drivers of biotechnology and healthcare are pushing the medical devices industry forward. In Orange County, medical device employers expect to increase hiring by almost 14% over the next 12 months, which would generate almost 2,400 new jobs. This is the highest percentage growth among California regions.

Figure 1: Growth in the next 12 months by region



[5] "Baby Boomers Driving Growth of Medical Electronics," Electronic News/Reed Business Information, 2004

[6] "07 Venture Capital Investment Hit Six-Year High," Electronic News/Yahoo Finance, 2008

Occupational Overview

The primary research component of this study focused on demand occupations within the medical device industry. To be selected for inclusion, the occupations had to meet at least one of the following criteria: high levels of employment in the region, above average growth, or an occupation easily served by community college-level education and training programs. The following eight occupations were identified through executive interviews with industry leaders as key jobs needed within the industry and as being most relevant to community college students[7]:

- Assemblers and/or Electrical and Electronic Assemblers
- Engineering and Operations Technicians
- Quality Control Technicians
- Research and Development Technicians
- Supervisors/Managers of Technicians and Maintenance Workers
- Clinical Trials and Regulatory Assistants and/or Technicians
- Inspectors, Testers and Graders
- Safety, Hazmat, and Environmental Controls Technicians

The occupational information was compiled using Employment Development Department (EDD) data and the results from telephone surveys with 83 Orange County Region medical device employers. The survey work was conducted by BW Research in collaboration with the Centers of Excellence in August 2007. Additional information was obtained at two Medical Device Industry conferences, Medical Design & Manufacturing West and Southern California Biomedical Council, and through individual conversations with employers.

[7] Occupation definitions listed in Appendix B

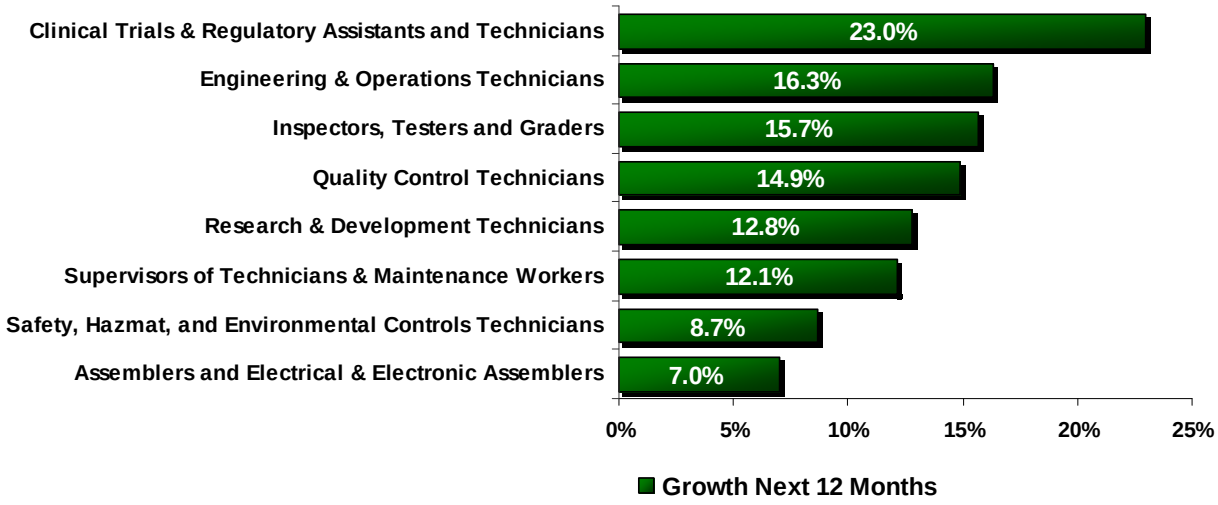
Table 2 shows estimated[8] 2006 Orange County region employment within the medical device industry, the number of expected openings from growth over the next 12 months for each of the occupations, and the median annual wage by occupation.

Table 2: Estimated New Jobs and Median Annual Wage by Occupation in Orange County

	Estimated 2006 Medical Device Employment	Growth Next 12 Months	Openings from Growth	Median Annual Wage
Assemblers and Electrical & Electronic Assemblers	3,210	7.0%	225	$28,588
Safety, Hazmat, and Environmental Controls Technicians	144	8.7%	13	$50,217
Supervisors of Technicians & Maintenance Workers	1,410	12.1%	171	$53,565
Research & Development Technicians	782	12.8%	100	$45,684
Quality Control Technicians	882	14.9%	131	$45,684
Inspectors, Testers and Graders	1,570	15.7%	246	$37,189
Engineering & Operations Technicians	2,220	16.3%	363	$45,282
Clinical Trials & Regulatory Assistants and Technicians	463	23.0%	106	$49,308

Figure 2 shows the growth for each occupation over the next 12 months.

Figure 2: Estimated Growth Needs by Occupation: Next 12 Months[9]



[8] Quality control technicians; research & development technicians; and safety, hazmat, and environmental controls technicians represent emerging occupations within medical devices and are not captured by the current SOC system. As such, employment for these three occupations was estimated from the survey data instead of the EDD data. Due to EDD data limitations, the same SOC data for wages was used for both quality control technicians and research and development technicians.

[9] Growth as estimated by the employers surveyed.

Employer Needs and Challenges

Figure 3 and 4 reveal the difficulty regional medical device employers indicated towards general workforce issues. Specifically, results of the survey show that nearly three out of every four employers have difficulty with “Recruiting employees with appropriate training and education” (68.7% difficulty).

One out of every two employers has difficulty providing training programs to keep employees up-to-date on changing technology and industry requirements (50.6% difficulty). This is particularly important in the medical device industry where employees need to be up to date with FDA regulations and procedures.

Figure 3: Workforce Challenges for Regional Employers in Orange County

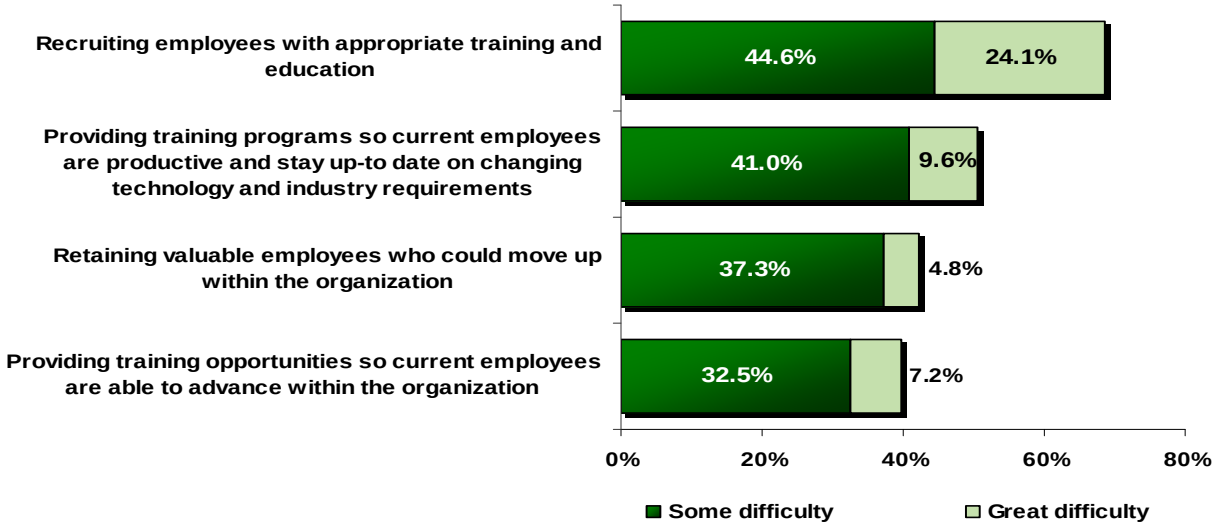
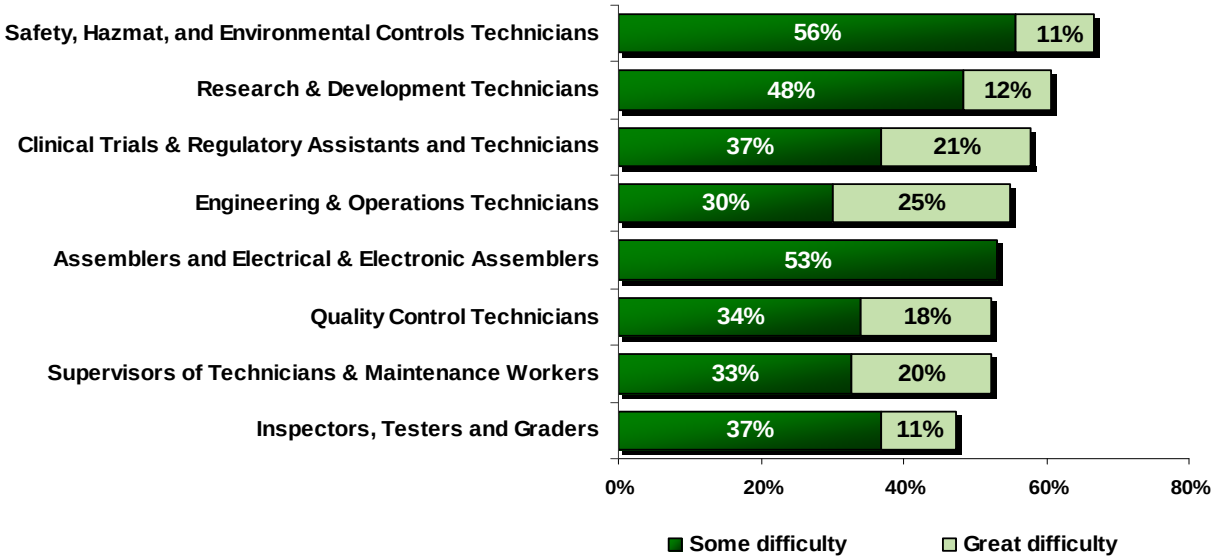


Figure 4: Difficulty Finding Applicants who Meet Hiring Standards

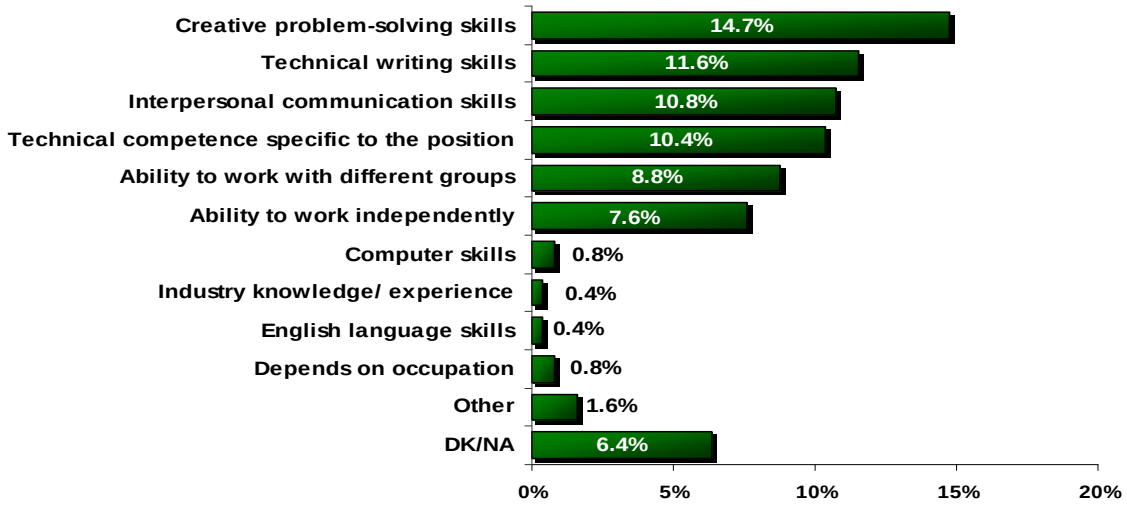


Another difficulty expressed by employers was the constant turnover created by employees leaving for companies that offered better pay and benefits, and the lack of a “qualified labor pool” from where to pick candidates.

Occupational Skills and Training Requirements

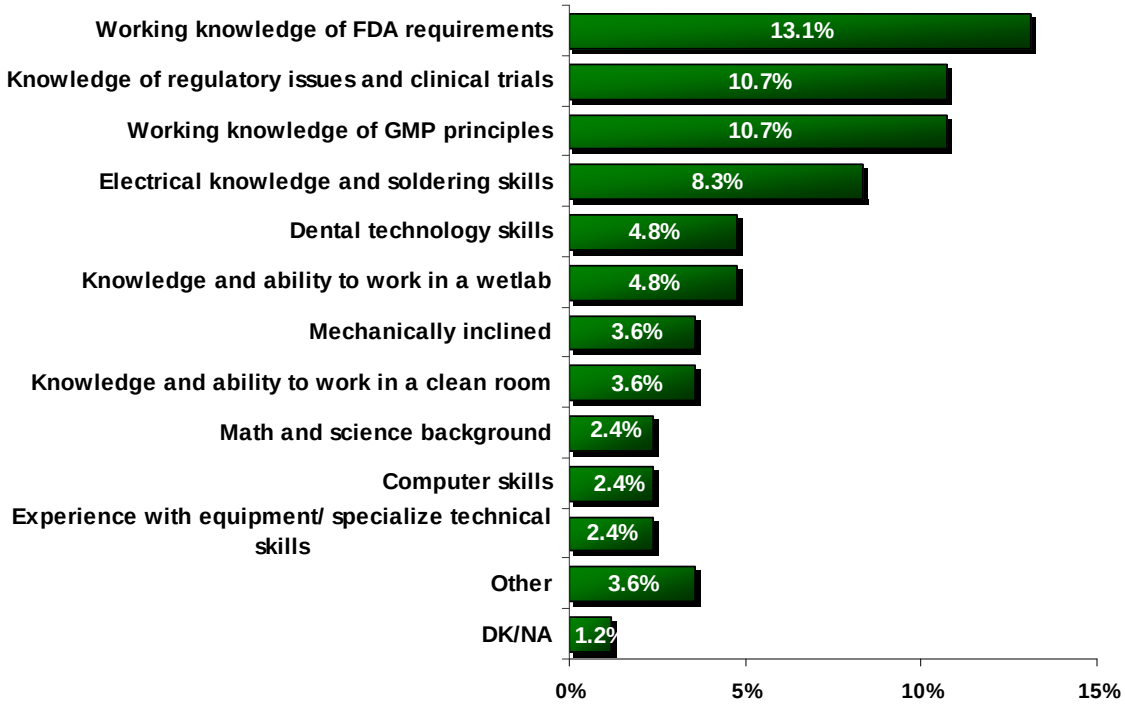
When asked to reflect on recent hires at their organization, employers indicated that new hires tend to be most deficient in creative problem-solving skills (14.7%) technical writing skills (11.6%), and interpersonal communication skills (10.8%).

Figure 5: General Skill Deficiencies Among Recent Hires



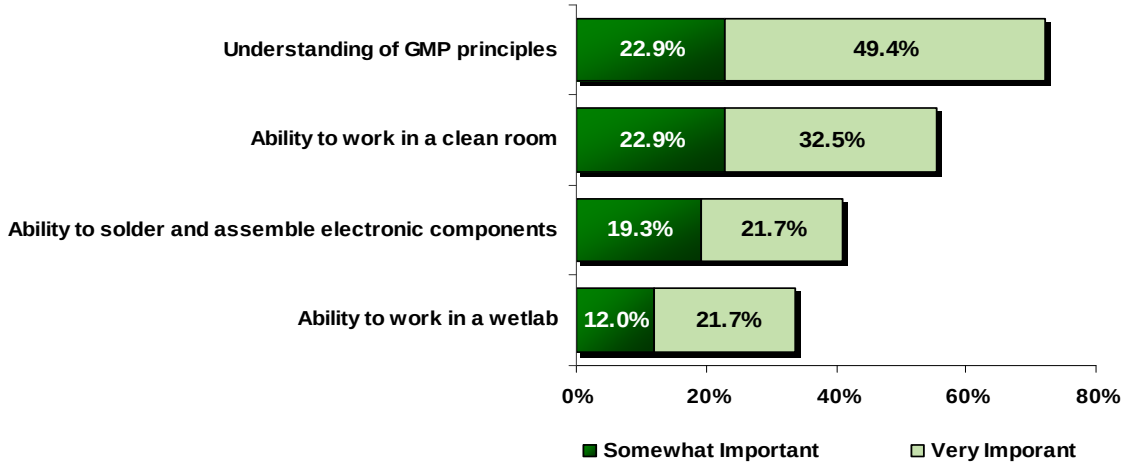
Among all the skills needed by technicians, employers indicated that working knowledge of Food and Drug Administration (FDA) requirements (13.1%), knowledge of regulatory issues and clinical trials (10.7%), and working knowledge of Good Manufacturing Practices (GMP) principles (10.7%) were the three most important.

Figure 6: Most Important Skills for Technicians in Orange County



Among the four specific knowledge areas tested in the survey for technicians, understanding of GMP principles and the ability to work in a clean room were viewed as the most important by employers.

Figure 7: Knowledge Areas Needed by Technicians in Orange County



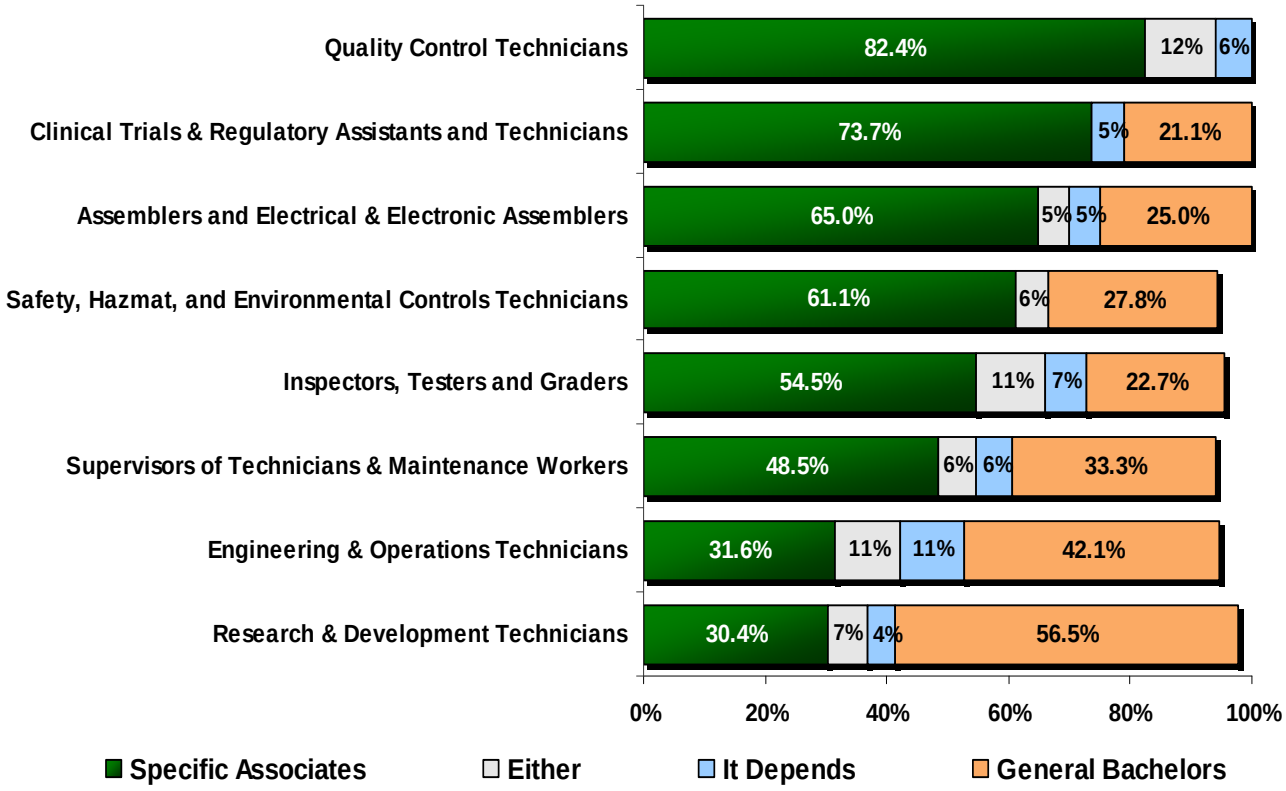
Educational Preferences

Medical device employers surveyed indicated a preference for an Associate's degree specific to the position over a general Bachelor's degree for six of the eight occupations, with the exception of engineering and operations technicians and research and development technicians. This preference however does not guarantee that employers will provide job opportunities for potential Associate's degree graduates.

Individual interviews conducted with employers revealed that having an Associate's degree was not a determining factor to obtain a job in the medical device industry. This is due to the following:

- Employers preferred to hire individuals who were already experienced in the medical device industry or biomedical sector, or who had experience in technical related jobs (i.e. electronic assembly).
- Many employers offered in-house training for entry level positions or used temporary employment agencies to fill those positions.
- A good number of medical device companies outsource their entry level jobs out of the country in order to reduce costs, and to concentrate on the Research and Development aspect of the business. These companies require candidates with higher levels of education, including Bachelor's, Master's, and PhD degrees.

Figure 8: Preferences for Specific Associates or General Bachelors



Workforce Opportunities

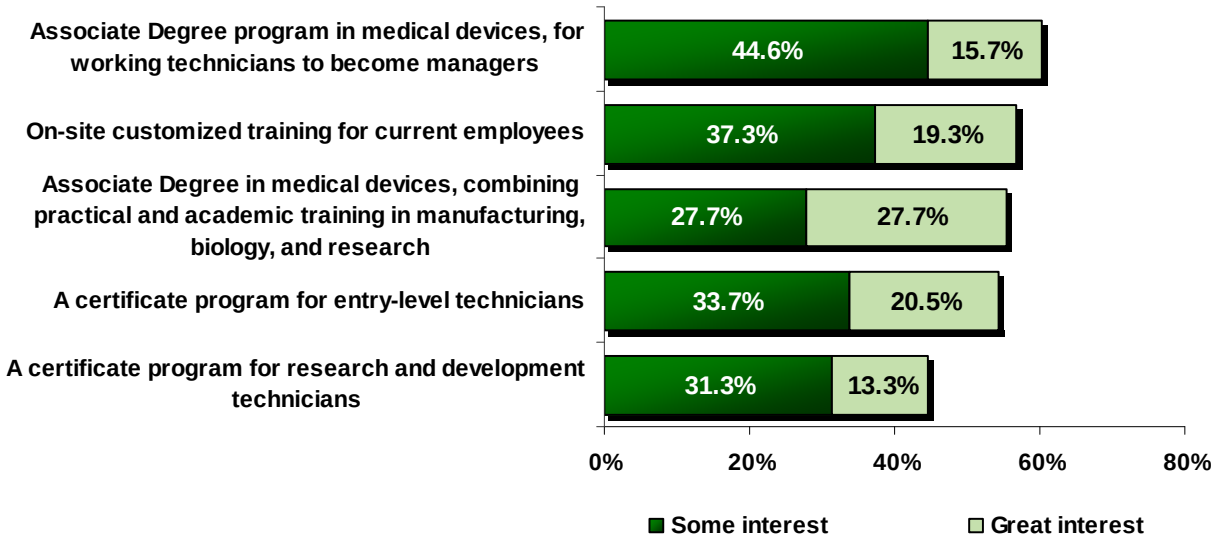
INTEREST IN POTENTIAL COMMUNITY COLLEGE PROGRAMS

Employers expressed the most overall interest in a medical device Associate's degree program for working technicians to become managers (60.2%).

The majority of employers also expressed interest in working with community colleges for on-site customized training for their current medical device employees (56.5%), as well as in a medical device Associate degree, which combines training in manufacturing, biology, and research (55.4%).

Medical Device employers who were surveyed and/or interviewed agreed that providing training to current employees was the area where they were more interested in working with community colleges.

Figure 9: Employer Interest in Potential Community College Programs



Community Support and Resources

There are excellent opportunities for regional colleges and Economic and Workforce Development (EWD) Initiatives to partner with employers, industry associations, and workforce agencies to meet the workforce needs of medical device employers. Well-developed partnerships can help to meet the current training needs of employers through a variety of resources and assistance. The table below summarizes existing and potential partnerships that can be leveraged.

Partner	Type of Organization	Contribution to Partnership
Southern California Biomedical Council www.socalbio.org	Life Science Industry Consortium	Access to Employers Partnership Development
Medical Device Industry Education Consortium (MDIEC), www.mdiec.org	Education & Industry Consortium	Industry-defined education & training solutions Curriculum Development Resources and Technical assistance
Workforce Investment Boards (WIBs) and One-Stop Centers (Anaheim, Santa Ana and Orange County WIBs) www.anaheimwib.com www.santaanawib.com www.ocwib.com	Public Workforce Development	Access to Job Seekers Access to Employers Training Funds Employment Resources
Regional Colleges and LA/OC Community College Consortium (LOWDL) www.laocrc.com	Workforce Training and Development	Education and Training (Associate Degrees, Certificates, Basic Skills; Incumbent

		Worker Training via Contract Education) Grant Funding and Assistance
UC Irvine (Extension Program) www.unex.uci.edu/certificates/life_sciences/medical_products	University	Technical Assistance Curriculum Development Incumbent Worker Training
Medical Device Training Initiative of Orange County www.mdtioc.org	Community College Medical Device Industry training program	Technical Assistance Curriculum Development Incumbent and New Worker Training
Centers for Applied Competitive Technologies (CACT) (North Orange County Community College District)	Community College EWD Program	Technical Assistance Curriculum Development Incumbent Worker Training
Orange County Business Council www.ocbc.org	Business Advocacy Group	Access to employers Partnership Development
California Manufacturing Technology Consulting (CMTC) www.cmtc.com	Business Assistance Group	Partnership Development Training Business Consulting
Centers of Excellence (COE) (Orange County and L.A. Regions)	Community College EWD Program	Forecasts Industry Workforce needs Industry Research Partnership Development

College Response and Issues

Existing Education Related to Medical Device Industry Occupations

North Orange County Community College District

The North Orange County Community College District's (NOCCCD) School of Continuing Education was awarded a 2-year Industry Driven Regional Collaborative (IDRC) grant to develop medical device industry-relevant curriculum and training for new and incumbent workers. Through this grant, the Medical Device Training Initiative of Orange County (MDTIOC) was created and is able to offer training programs at no cost to companies and employees during a limited period of time.

MDTIOC has partnered with key industry experts to create a Medical Device Certificate Program. The program consists of the following four 8-hour courses:

- Introduction to the Medical Device Industry
- Quality Systems/ISO 13485:2003

- Overview of FDA's Medical Device Regulations
- Fundamentals of Good Manufacturing Practices (GMP) and Quality System Regulations (QSR)

Completion of all four courses is necessary to obtain a certificate. More information can be obtained at http://www.mdtioc.org/

Anoka-Ramsey Community College

Anoka-Ramsey Community College in Minnesota has developed a Biomedical Technology program focused on the medical device industry. Students can get an Associate in Science degree in Biomedical Technology to prepare for entry, career transition or advancement in the medical device industry - from manufacturing to clinical research. Students can also attain a Biomedical Technician Certificate or a Clinical Research Professional Certificate. Appendix G has additional information about these programs and links to the college website where curriculum information is available. More information can be obtained at http://www.ar.cc.mn.us/biomedical/

University of California at Irvine

The University of California at Irvine offers a Medical Product Development Certificate Program through its Extension Program. The curriculum addresses the breadth of the development process, including a thorough understanding of compliance, engineering for improved performance, how to mitigate commercial and financial risks, and building marketing success.

The program consists of the following courses:

- Medical Product Life-Cycle Management (Required)
- Regulatory Requirements for Medical Devices (Required)
- Regulatory Requirements for Pharmaceutical Products or Medical Product Quality Systems (Required)

There are an additional 6 elective units; candidates can select from 15 different courses ranging from 1.5 to 3 units in order to meet this requirement. Information on these courses can be obtained at http://unex.uci.edu/certificates/life_sciences/medical_products/

Conclusion and Recommendations

The medical device industry is a significant and growing industry in the Orange County region. In 2006, the industry employed 100,459 individuals in the state of California, of which 17,633 worked in Orange County.

As part of this study, data validation efforts were conducted with employers and industry representatives during two Medical Device Industry Conferences, Medical Device & Manufacturing West and Southern California Biomedical Council, and through individual conversations/interviews with medical device employers. The results indicated the following:

- An Associate's degree in Medical Devices was not relevant in the hiring of new employees. Employers preferred to hire individuals who were already experienced in the medical device industry or biomedical sector, or who had experience in technical related jobs (i.e. electronic assembly).
- Many employers offered in-house training for entry level positions or used temporary employment agencies to fill those positions.
- A good number of medical device companies outsource their entry level jobs out of the country in order to reduce costs, and to concentrate on the Research and Development aspect of the business. These companies require candidates with higher levels of education, including Bachelor's, Master's, and PhD degrees.
- Employers expressed a great interest in customized training programs and Associate's degrees for their current employees.

Based on these findings, this study does not see a need for local community colleges to create new classes or curriculum on medical devices, but rather to prepare students majoring in health science programs for transfer to a four-year university, and for Contract Education departments to work with medical device employers to offer customized training for their current workforce. This could be accomplished in the following manner:

1. Partner with career counseling programs at local community colleges to increase awareness about the opportunities in the medical device industry for those students interested in the health science programs. Learning about these opportunities at the start of their college career will help students look at medical device companies as future employers once they finish their four-year degrees.

2. Work with North Orange County Community College District's Office of Continuing Education. Through the Medical Device Initiative of Orange County, the district offers employers an excellent opportunity for industry specific training for their current workforce. This is a model that could be very useful for Contract Education departments looking to provide training to medical device companies.

3. Work with UC Irvine's Extension Program. The Medical Product Development Certificate Program has a variety of courses tailored specifically for the Medical Device Industry and for the working

professional. Again, this program could be a good model for Contract Education departments.

4. Work with California Manufacturing Technology Consulting (CMTC) in order to provide training incentives for medical device companies interested in training their workforce. CMTC has secured funding from the Employment Training Panel (ETP) to offset the cost of providing high-quality, customized training solutions. Contract Education departments can partner with CMTC in order to provide customized training at a cost that will be more attractive to employers.

Community colleges can play a pivotal role in assisting medical device companies to train their current workforce. Due to the highly regulated work environment in the industry, it is extremely important that employees are up to date with FDA regulations and procedures. In addition, medical device employers need to create future job opportunities for those employees interested in moving up to supervisory or more specialized positions. In doing so, career ladders will be created for those individuals already employed, and the vacancies created from those being promoted will provide entry level applicants with job opportunities.

Creating this pipeline or employment cycle is of extreme importance for medical device employers in order to reduce employee turnover, and to meet the growing demands of the industry. Through their Contract Education departments, community colleges can become the ideal partner that can help medical device employers meet their employment and training needs.

Data Limitations

During development of this report, there were significant limitations encountered with the EDD data on the industry. Because EDD data did not identify the full range of occupations specific to the industry, the projected job growth and skill requirements for these occupations was not available. In addition, using EDD's data to perform a "crosswalk" from industry NAICS codes to the related SOC codes (occupational titles) showed multiple industries employing most of the occupations identified, not just the medical device industry. Therefore accurate projections could not be made regarding what part of the projected growth for occupations could be attributed to the medical device industry.

This gap in information led to the need for primary research to identify the specific occupations for which the industry has demand and the job growth projections for these occupations. This employer data, not available from public data sources, was obtained through primary research described in this report which identified the specific skill sets required by employers for demand occupations, and validated the secondary research already gathered.

References

California State EDD LMID (www.labormarketinfo.edd.ca.gov)

Electronic News/Reed Business Information, “Baby Boomers Driving Growth of Medical Electronics,” 2004

Electronic News/Yahoo Finance, “07 Venture Capital Investment Hit Six-Year High,” 2008

Medical Device Industry Education Consortium, http://www.mdiec.org

Medical Devices Manufacturers’ Association, http://medicaldevices.org

North American Industry Classification System, http://www.census.gov/epcd/www/naics.html

Overview: FDA Regulation of Medical Devices, http://www.qrasupport.com/FDA_MED_DEVICE.html

U.S. Census Bureau, “Projected Population of the United States, by Age and Sex, 2000 to 2050”

Appendix A: How to Utilize this Report

About Us - Description of BWPI

The Business and Workforce Performance Improvement (BWPI) initiative is focused on building the capacity of the colleges in the area of economic and workforce development to enhance their ability to deliver education and training services to businesses and workers in high growth industries, new technologies, and other clusters of opportunities.

The Centers of Excellence (COE) within BWPI provide information regarding workforce trends, increasing awareness and visibility about the colleges' economic and workforce development programs and services, and building partnerships with business and industry.

The goal is to position the colleges as THE workforce partners of choice to business and industry and ensure that college programs are current and responsive. This will contribute to the overall economic vitality of the communities in which they serve.

How to Use This Report

The Centers of Excellence within the Business and Workforce Performance Improvement Initiative of the California Community College Economic and Workforce Development Program have undertaken Environmental Scanning to provide targeted and valuable information to community colleges on high growth industries and occupations.

This report is intended to assist the decision-making process of California community college administrators and planners in addressing local and regional workforce needs and emerging job opportunities in the workplace as they relate to college programs. The information contained in this report can be used to guide program offerings, strengthen grant applications, and support other economic and workforce development efforts. This report is designed to provide current industry data that will:

- Define potential strategic opportunities relative to an industry's emerging trends and workforce needs
- Influence and inform local college program planning and resource development
- Promote a future-oriented and market responsive way of thinking among stakeholders.

This Environmental Scan included a review of the California Regional Economies Project reports and Employment Development Department (EDD) Labor Market Information (LMID) projections that cover the communities in this region, as well as many other sources as referenced.

Important Disclaimer:

All representations included in this Environmental Scan product/study have been produced from a secondary review of publicly and/or privately available data and/or research reports. Efforts have been made to qualify and validate the accuracy of the data and the reported findings. The purpose of the Environmental Scan is to assist the California Community Colleges to respond to emerging market needs for workforce performance improvement. However, neither the Business and Workforce Performance Improvement Centers of Excellence, COE host college or California Community Colleges Chancellor's Office are responsible for applications or decisions made by recipient community colleges or their representatives based upon this study including components or recommendations.

Additional Information

The Business and Workforce Performance Improvement Initiative is funded in part by the Chancellor's Office, California Community Colleges, Economic and Workforce Development Program. The total grant amount (grant number 07-305-012 for $205,000) represents compensation for multiple documents or written reports through the Center of Excellence.

Our mission is to strengthen California's workforce and advance economic growth through education, training and job development.

Appendix B Occupational Summary

This Occupational Summary synthesizes all the secondary research and employer survey data separately for each of the eight occupations of interest for the study.

Although there is no single equation that can be applied to identify the probability that an occupation will be undersupplied in the future, a combination of the data sources evaluated in this project[10] allows for an estimate of those occupations that have the highest potential to be undersupplied in the future.

Table E-1 Occupational Assessment Categories

RED	**Occupations that provide the STRONGEST indication that they will be undersupplied in the future**
YELLOW	**Occupations that provide SOME indication that they will be undersupplied in the future**
GREEN	**Occupations that provide LITTLE TO NO indication that they will be undersupplied in the future**

Table E-2 Occupational Assessment

RED OCCUPATIONS
Engineering and Operations Technicians
Clinical Trials and Regulatory Assistants and Technicians
YELLOW OCCUPATIONS
Quality Control Technicians
Research and Development Technicians
Supervisors/ Managers of Technicians & Maintenance Workers
Assemblers and/or Electrical & Electronic Assemblers
Inspectors, Testers and Graders
GREEN OCCUPATIONS
Safety, Hazmat, and Environmental Controls Technicians

Clinical Trials & Regulatory Assistants and/or Technicians

The work of clinical trials and regulatory assistants and/or technicians involves assisting or performing complex medical laboratory tests, evaluating test results,

[10] A combination of quantitative and qualitative factors from secondary data sources as well as the employer data from both the executive interviews and quantitative survey.

developing and modifying procedures, and establishing and monitoring programs to ensure the accuracy of tests.

The critical skill sets include a strong science and mathematics background, good analytical judgment, close attention to detail, and ability to work under pressure.

This is an entry to mid-level position, with most occupations in this category requiring at least a vocational or associate's degree, and some requiring a bachelor’s degree.

Engineering & Operations Technicians

The work of engineering and operations technicians involves applying the principles and theories of science, engineering, and mathematics to solve technical problems. Many engineering technicians assist engineers and scientists, especially in research and development.

The critical skill sets include a strong engineering and mathematics background, mechanical aptitude, good analytical judgment, and close attention to detail.

This is an entry to mid-level position, with most occupations in this category requiring vocational training or an associate's degree.

Quality Control Technicians

The work of quality control technicians involves the performance and record keeping associated with quality control testing and implementing corrective and preventive action plans for non-conformances.

The critical skill sets include knowledge of production and processing, knowledge of engineering and technology, mechanical aptitude, the ability to conduct quality control analysis, and strong troubleshooting, problem solving, and record-keeping skills.

This is an entry to mid-level position, with most occupations in this category requiring training in vocational schools, related on-the-job experience, or an associate's degree.

Research & Development Technicians

The work of research and development technicians involves supporting new product development or product revisions by implementing aspects of research, construction, testing, documentation, problem correction, and related tooling.

The critical skill sets include knowledge of production and processing, strong science, mathematics and/ or engineering skills, detail-oriented nature, and troubleshooting and problem solving skills.

This is an entry to mid-level position, with most occupations in this category requiring training in vocational schools, related on-the-job experience, or an associate's degree, and some requiring a bachelor’s degree.

Supervisors/ Managers of Technicians & Maintenance Workers

The work of supervisors or managers of technicians and maintenance workers can vary greatly depending on the work environment. Duties can include directing and coordinating the activities of employees, enforcing safety and sanitation regulations, inspecting materials, products, or equipment to detect defects or malfunctions, and interpreting specifications, blueprints, job orders, and company policies and procedures for workers.

The general skill sets for supervisors or managers of technicians and maintenance workers include mechanical and technical aptitude, ability to coordinate the work of others, leadership, communication skills, and any appropriate agency-specific knowledge.

This is a mid-level position, with most occupations in this category requiring training in vocational schools, related on-the-job experience, or an associate degree. Some may require a bachelor's degree.

Assemblers and/or Electrical & Electronic Assemblers

The work of assemblers and/or electrical and electronic assemblers involves assembling or modifying electrical, electronic, or electromechanical equipment or devices as well as performing precision assembling or adjusting.

The critical skill sets include knowledge of production and processing, knowledge of engineering and technology, mechanical aptitude, the ability to conduct quality control analysis, troubleshooting, understanding of equipment selection, and sound judgment and decision making skills.

This is an entry-level position, with most occupations in this category requiring training in vocational schools, related on-the-job experience, or an associate's degree.

Inspectors, Testers and Graders

The work of inspectors, testers and graders involves monitoring or auditing quality standards for manufactured products and they are involved at every stage of the production process. Job duties, even within one company, vary by the type of products produced or the stage of production.

The critical skill sets include mechanical aptitude, math and communication skills, and good hand-eye coordination and vision. As automated inspection equipment and electronic recording of results is common, computer skills are also important.

This is an entry-level position, with the training requirements dependent on the responsibilities of the inspector, tester, or grader. For basic “pass/fail” tests of

products, a high school diploma and basic in-house training is generally sufficient. However, postsecondary training and more in-depth on-the-job training is often required for a position responsible for more advanced tests of products.

Safety, Hazmat and Environmental Controls Technicians

The work of safety, hazmat and environmental controls technicians involves identifying where controls need to be implemented to reduce or eliminate potential hazards in systems, equipment, products, facilities, or processes. As necessary, they conduct training sessions for management, supervisors, and workers on health and safety practices and regulations to promote an understanding of a new or existing process. After implementation, they may monitor and evaluate the program’s progress, making additional suggestions when needed.

The critical skill sets include training and/or certification in the applicable laws or inspection procedures, strong science and mathematics background, good communication skills, and a detail-oriented nature.

This is an entry to mid-level position, with most occupations in this category requiring training in vocational schools, related on-the-job experience, or an associate's degree. Some may require a bachelor's degree.