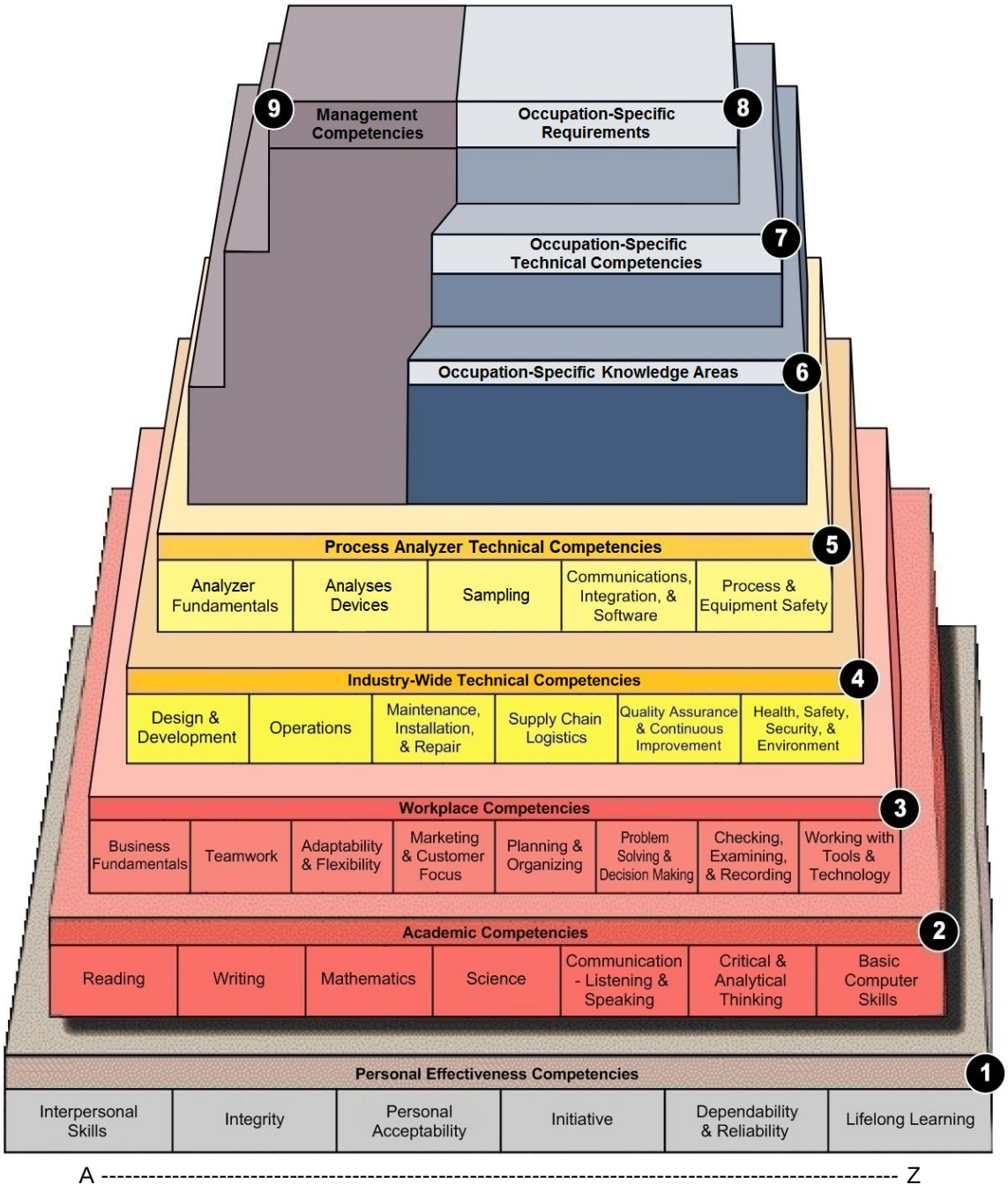
Analyzer Technician Competency Model



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Analyzer Technician Competency Model

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Analyzer Technician Competency Model

About The Model

The Analyzer Technician Competency Model is depicted in a pyramid graphic with nine tiers. This shape illustrates how occupational competencies build on a foundation of personal effectiveness, academic, and workplace competencies. Each tier is comprised of blocks representing the skills, knowledge, and abilities essential for successful performance in the occupation. At the base of the model, the competencies may apply to a large number of occupations and industries. The competencies become occupation specific moving up the tiers of the model. However, the graphic is not intended to represent a sequence of competency attainment or suggest that certain competencies are of greater value or higher skill than others. The graphic is supported with definitions, critical work functions and technical content areas as appropriate for each competency block.

Competency Model Tiers

Tiers 1 through 3, generally referred to as Foundation Competencies, form the foundation needed to be ready to enter the workplace.

> Tier 1 – Personal Effectiveness Competencies are shown as hovering below the pyramid because they represent personal attributes or "soft skills" that may present some challenges to teach or assess. Essential for all life roles, personal effectiveness competencies generally are learned in the home or community and reinforced at school and in the workplace.
>
> Tier 2 – Academic Competencies are critical competencies primarily learned in a school setting. They include cognitive functions and thinking styles, and are likely to apply to most industries and technician level occupations.
>
> Tier 3 – Workplace Competencies represent motives and traits, as well as interpersonal and self-management styles honed in the workplace. They generally are applicable to a large number of industries and technician level occupations.

Tiers 4 and 5, generally referred to as Industry Competencies, show competencies that are specific to the process industry for analyzer technicians working in the field.

> Tier 4 – Industry Wide Technical Competencies represent the knowledge and skills that are common across the process industry. These technical competencies generally build on and are more specific to the industry than a competency represented in the foundational tiers.
>
> Tier 5 – Process Analyzer Technical Competencies represent technical competencies that are specific to the process industry for analyzer technicians working in the field.

Tiers 6 through 9 represent the specialization that occurs within an industry or at a plant site for occupation specific technologies, applications, procedures, requirements and career growth.

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Analyzer Technician Competency Model

Tier 1 - Personal Effectiveness Competencies

A. Interpersonal Skills: Demonstrating the ability to work effectively with others.

1. Be flexible and open-minded when dealing with a wide range of people
2. Interact appropriately and respectfully with supervisors and coworkers
3. Listen to and consider others' viewpoints
4. Respect the opinions, perspectives, customs, and individual differences of others
5. Use appropriate strategies and solutions for dealing with conflicts and differences to maintain a smooth workflow
6. Work effectively with people who have diverse personalities and backgrounds

B. Integrity: Displaying accepted social and work behaviors.

1. Accept responsibility for one's decisions and actions
2. Comply with ethical standards for your field
3. Maintain confidentiality as appropriate about matters encountered in the workplace
4. Practice honesty with regard to company time and property
5. Take responsibility for accomplishing work goals within accepted timeframes
6. Treat others with honesty, fairness, and respect

C. Personal Acceptability: Maintaining a socially acceptable demeanor.

1. Accept criticism and attempt to learn from mistakes
2. Demonstrate a positive attitude towards work
3. Demonstrate self-control by maintaining composure and dealing calmly with stressful situations
4. Follow rules and standards of dress
5. Follow rules and standards of personal hygiene
6. Refrain from substance abuse

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Tier 1 - Personal Effectiveness Competencies

D. Initiative: Demonstrating a willingness to work.

1. Contribute to solving problems on the job through suggestions, recommendations and communication
2. Establish and maintain personally challenging, but realistic work goals
3. Persist at a task despite interruptions, obstacles, or setbacks
4. Pursue work with energy, drive, and effort to accomplish tasks
5. Strive to exceed standards and expectations
6. Take initiative in seeking out new responsibilities and work challenges

E. Dependability and Reliability: Displaying responsible behaviors at work.

1. Avoid absenteeism
2. Behave consistently, predictably, and reliably
3. Comply with organizational rules, policies, and procedures
4. Do not attend to personal business on the job
5. Follow written and verbal directions
6. Fulfill obligations, complete assignments, and meet deadlines

F. Lifelong Learning: Displaying a willingness to learn and apply new knowledge and skills.

1. Broaden knowledge and skills through job shadowing, continuing education and with help from supervisors and coworkers
2. Demonstrate an interest in personal and professional lifelong learning and development
3. Maintain certifications and continuing education credits
4. Read technical publications to stay abreast of new developments in the industry
5. Seek and maintain membership in professional associations
6. Seek feedback, and modify behavior for improvement
7. Take charge of personal career development by identifying personal interests and career pathways
8. Treat unexpected circumstances as opportunities to learn and adopt new techniques
9. Use newly learned knowledge and skills to complete specific tasks

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Tier 2 - Academic Competencies

A. Reading: Understanding written English sentences and paragraphs in work-related documents.

1. Identify relevant details, facts, specifications, and main ideas
2. Infer or locate meaning of unknown or technical vocabulary
3. Locate, understand, and interpret written technical and non-technical information in documents such as manuals, reports, memos, graphs, charts, tables, schedules, signs, and regulations
4. Understand the essential message and purpose of written materials

B. Writing: Using standard English to compile information and prepare written reports.

Mechanics

1. Use standard syntax and sentence structure
2. Use correct spelling, punctuation, and capitalization; use appropriate grammar (e.g., correct tense, subject-verb agreement, no missing words)
3. Write in a manner appropriate for business; use language appropriate for the target audience; use appropriate tone and word choice (e.g., writing is professional and courteous)

Organization and development

4. Create documents such as letters, directions, manuals, reports, graphs, and flow charts
5. Communicate thoughts, ideas, information, messages, and other written information, which may contain technical material, in a logical, organized, coherent, and persuasive manner
6. Develop ideas with supporting information and examples

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Tier 2 - Academic Competencies

C. Mathematics: Using principles of mathematics such as algebra, geometry, and trigonometry to solve problems.

1. Number Systems and Relationships - whole numbers, decimals, fractions, alternate base systems (e.g. binary, octal, and hexadecimal numbers)
2. Arithmetic - arithmetic operations on numbers, percentages, square root, exponentiation, and logarithmic functions
3. Plane and Solid Geometry - distance, perimeter, area, and volume, spatial coordinates, visualization, spatial reasoning, and geometric modeling
4. Measurement - measurement of length, mass, weight, time, speed, acceleration, systems of measurement, units, and conversion between systems (e.g. from English to metric)
5. Mathematical Notation - the language of mathematics to express mathematical ideas – translating verbal or written problems into mathematical equations
6. Mathematical Reasoning and Problem Solving - inductive and deductive reasoning, conjectures, arguments, strategies, and interpretation of results
7. Elementary Statistics and Laws of Probability - mean, median, and standard deviation
8. Algebra and Functions - equations, patterns, and functions

D. Science: Knowing and applying scientific principles and methods to solve problems.

1. Scientific Method - the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of a hypothesis
2. Chemistry - the composition, structure, properties, and reactions of matter, especially nomenclature of atomic and molecular compounds, organics and water chemistry
3. Physics – matter, energy and physical interactions

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Tier 2 - Academic Competencies

E. Communication-Listening and Speaking: Giving full attention to what others are saying and speaking in English well enough to be understood by others.

Listening

1. Receive, attend to, interpret, understand, and respond to verbal messages and other cues
2. Apply active listening skills using reflection, restatement, questioning, and clarification
3. Pick out important information in verbal messages
4. Appreciate feelings and concern of verbal messages
5. Understand complex instructions and act upon them to complete assignments

Speaking and Presenting

6. Speak clearly and confidently using common English conventions including proper grammar, tone, and pace
7. Express information to individuals or groups taking into account the audience and the nature of the information (e.g., explain technical concepts to non-technical audiences)
8. Effectively use eye contact and non-verbal expression
9. Present ideas in a persuasive manner

F. Critical and Analytical Thinking: Using logic, reasoning, and analysis to address problems.

1. Draw conclusions from relevant or missing information
2. Organize problems into manageable parts
3. Understand the underlying relationship among facts and connections between issues
4. Use inductive and deductive reasoning to analyze, synthesize, compare, and interpret information
5. Use logic and reasoning to identify strengths and weaknesses of alternative solutions, conclusions, or approaches to problems

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Tier 2 - Academic Competencies

G. Basic Computer Skills: Using a computer and related applications to input and retrieve information.

Databases

1. Use a computer application to manage large amounts of information
2. Create and edit simple databases
3. Input data
4. Retrieve detailed records
5. Create reports to communicate the information

Graphics

6. Work with pictures in graphics programs or other applications
7. Create simple graphics
8. Manipulate the appearance of graphics
9. Insert graphics into other files/programs

Internet and E-mail

10. Navigate the Internet to find information
11. Open and configure standard browsers
12. Use searches, hypertext references, and transfer protocols
13. Send and retrieve electronic mail (e-mail)
14. Write e-mail with an appropriate business tone and expression

Navigation and File Management

15. Use scroll bars, a mouse, and dialog boxes to work within the computer's operating system
16. Access and switch between applications and files of interest

Presentations

17. Use a computer application to create, manipulate, edit, and show virtual slide presentations

Spreadsheets

18. Use a computer application to enter, manipulate, and format text and numerical data
19. Insert, delete, and manipulate cells, rows, and columns
20. Create and save worksheets, charts, and graphs

Word Processing

21. Use a computer application to type text, insert pictures
22. Format, edit, and print text
23. Save and retrieve word processing documents

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Tier 3 - Workplace Competencies

A. Business Fundamentals: Knowledge of basic business principles, trends, and economics such as: Characteristics of Markets; Cost and Pricing of Products; Economic Terminology; Fundamentals of Accounting; Profit and Loss; Supply/Demand.

Business Ethics

1. Act in the best interests of the company, your co-workers, your community, other stakeholders, and the environment
    a. Legal/Financial
        i. Comply with the letter and spirit of applicable laws
        ii. Use company property legitimately, minimizing loss and waste; report loss, waste, or theft of company property to appropriate personnel
        iii. Maintain privacy and confidentiality of company information, as well as that of customers and co-workers
        iv. Comply with intellectual property laws
        v. Protect trade secrets
    b. Environmental/Health/Safety
        i. Maintain a healthful and safe environment and report any violations/discrepancies
        ii. Ensure proper handling and disposal of toxic or hazardous materials
        iii. Practice sustainability by using processes that are non-polluting, conserving of energy and natural resources, economically efficient, and safe for workers, communities, and consumers
        iv. Safeguard the public interest
    c. Social
        i. Treat co-workers fairly and with respect
        ii. Emphasize quality, customer satisfaction and fair pricing
        iii. Deal with customers in good faith, no bribes, kickbacks, or excessive hospitality

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Tier 3 - Workplace Competencies

Economic System as a Framework for Decision-making

2. Understand how one's performance can impact the success of the organization
3. Consider the relative costs and benefits of potential actions to choose the most appropriate one

Marketing

4. Demonstrate an understanding of market trends, company's position in the market place, and defined market segments
5. Understand position of product/service in relation to market demand
6. Uphold the company and product brand through building and maintaining customer relations
7. Integrate internal and external customer demands and needs into manufacturing product and process development

B. Teamwork: Working cooperatively with others to complete work assignments.

1. Accept membership in and commit to achieve the mutual goals of a team
2. Be open to new ideas, new ways of doing things, and the merits of new approaches when dealing with a wide range of people
3. Collaborate with others to formulate team objectives and develop consensus for best outcome
4. Develop effective relationships with highly diverse personalities
5. Express opinions openly and respect others' right to do so
6. Give and receive feedback constructively - alter opinion when it is appropriate to do so
7. Identify roles of team members and effectively communicate with all members of the team
8. Recognize one's own effects on team performance
9. Use teamwork skills to achieve goals, solve problems, and manage conflict
10. Work effectively with multi-disciplinary teams

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Tier 3 - Workplace Competencies

C. Adaptability and Flexibility: Being open to change (positive or negative) and to considerable variety in the workplace.

Deal with ambiguity

1. Take effective action when necessary without having to have all the necessary facts in hand
2. Change gears in response to unpredictable or unexpected events
3. Effectively change plans, goals, actions, or priorities to deal with changing situations

Entertain new ideas

4. Is open to considering new ways of doing things
5. Actively seek out and carefully considers the merits of new approaches to work
6. Willingly embrace new approaches when appropriate and discards approaches that are no longer working

D. Marketing and Customer Focus: Actively looking for ways to identify market demands and meet the customer, client, or stakeholder need.

Act professionally

1. Be pleasant, courteous, and professional when dealing with internal or external customers
2. Develop constructive and cooperative working relationships with customers
3. Display a good-natured, cooperative attitude; is calm and empathetic when dealing with hostile customers
4. Uphold the company and product brand in interactions with others

Keep customers informed

5. Follow up with customers during projects and following project completion
6. Keep clients up to date about decisions that affect them
7. Seek the comments, criticisms, and involvement of customers
8. Adjust services based on customer feedback
9. Address customer comments, questions, concerns, and objections with direct accurate and timely responses

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Tier 3 - Workplace Competencies

Provide personalized service

10. Provide prompt and efficient responses to meet the requirements, requests, and concerns of customers
11. Provide thorough, accurate information to answer customers' questions and to meet commitment times or performance guarantees
12. Actively look for ways to help customers by identifying and proposing appropriate solutions and/or services
13. Establish boundaries as appropriate for unreasonable customer demands

Understand customer needs

14. Identify internal and external customers
15. Demonstrate a desire to understand customer needs
16. Anticipate the future needs of the customer
17. Ask questions as appropriate
18. Demonstrate awareness of client goals

E. Planning and Organizing: Planning and prioritizing work to manage time effectively and accomplish assigned tasks.

Allocate Resources

1. Estimate resources needed for project completion
2. Allocate time and resources effectively
3. Coordinate efforts with all affected parties
4. Keep all parties informed of progress and all relevant changes to project timelines

Plan

5. Approach work in a methodical manner
6. Plan and schedule tasks so that work is completed on time
7. Keep track of details to ensure work is performed accurately and completely
8. Anticipate obstacles to project completion
9. Develop contingency plans to address them
10. Take necessary corrective action when projects go off track

Prioritize

11. Prioritize various competing tasks
12. Perform tasks quickly and efficiently according to their urgency
13. Find new ways of organizing work area or planning work to accomplish work more efficiently

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Tier 3 - Workplace Competencies

F. Problem Solving and Decision Making: Applying critical-thinking skills to solve problems by generating, evaluating, and implementing solutions.

Identify the problem

1. Anticipate or recognize the existence of a problem
2. Define the problem
3. Locate and obtain all information relevant to the problem
4. Identify potential causes of the problem by analyzing its component parts
5. Recall previously learned information that is relevant to the problem
6. Communicate the problem to appropriate personnel

Generate innovative solutions

7. Think creatively to generate a variety of approaches to the problem
8. Integrate seemingly unrelated information to develop creative solutions
9. Develop innovative methods of obtaining or using resources when insufficient resources are available
10. Demonstrate innovative thinking by using new and existing technology in new ways
11. Translate problems into useful mathematical expressions
12. Use logic and reasoning to evaluate the relative merits of the various solutions, conclusions, or approaches

Choose a solution

13. Decisively choose the best solution after contemplating available approaches to the problem
14. Make difficult decisions even in highly ambiguous or ill-defined situations
15. Quickly choose an effective solution without assistance when appropriate

Implement the solution

16. Commit to a solution in a timely manner
17. Develop a realistic approach for implementing the chosen solution
18. Use strategies, tools, resources, and equipment to implement the solution
19. Observe and evaluate the outcomes of implementing the solution to assess the need for alternative approaches and to identify lessons learned

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Tier 3 - Workplace Competencies

G. Checking, Examining, and Recording: Entering, transcribing, recording, storing, or maintaining information in written or electronic/magnetic format.

1. Apply systematic techniques for observing and gathering data
2. Compile, code, categorize, calculate, inspect, or verify information or data
3. Detect and correct errors or inconsistencies
4. Organize records and files to maintain data
5. Record data in controlled documentation files or system

H. Working with Tools and Technology: Selecting, using, and maintaining tools and technology to facilitate work activity.

Selection and Application

1. Identify, select, and apply appropriate tools (hand tools, handheld electronic devices and reference material) or cost-effective technological solutions
2. Identify potential hazards related to the use of tools and equipment
3. Utilize tools and equipment in accordance with established operating procedures and safety standards
4. Use communication technology and computer applications as it supports the gathering, storage, manipulation, and conveyance of data and information

Maintenance and Troubleshooting

5. Perform routine maintenance on tools, technology, and equipment
6. Determine causes of operating errors and decide what to do about it
7. Troubleshoot maintenance problems in accordance with established procedures
8. Use developed capacities to correct malfunctions
9. Use appropriate methods and instructions to ensure equipment is used safely and without damage to the equipment

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Tier 4 - Industry Wide Technical Competencies

A. Design and Development: Research and design for the application of analyzer technology to monitor and control the production of goods and services.

Critical Work Functions

1. Communicate about and respond to requirements of internal and external customers.
2. Interpret and clarify customer expectations and product specifications.
3. Support systems design and development of analyzer applications

Technical Content Areas

Technical Drawings and Schematics

4. CAD Drawing Fundamentals
5. Geometric Dimensions and Tolerances
6. Interpretation of Drawings and Schematics
7. Print Reading and Redlining

Testing/Troubleshooting

8. Fault Finding Skills on Actual Equipment
9. Data Analysis and Verification
10. Data Interpretation and Corrective Action Implementation
11. Statistical Process Control

Workflow Assessment

12. Work Flow Simulation
13. Procedure Analysis and Verification
14. Resource Planning

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Tier 4 - Industry Wide Technical Competencies

B. Operations: Setup, operate, monitor, analyze, and improve analyzer technology that supports production and process schedules to meet customer requirements.

Critical Work Functions

1. Manage raw materials/consumables/outputs.
2. Monitor industrial analyzer processes and systems.
3. Support operation and control of analyzer technology for production/process operations.

Technical Content Areas

Industrial Production and Process Basics including but not limited to:

4. Industrial Processes for processing, transporting or conveying liquids, gases, or goods in pipes or conveyers:

   Balancing, Compression, Continuous flow, Fermentation, Filtration, Mixing, Pumping, Reaction, Recovery, Separation – Distillation, extraction, absorption, adsorption, etc.

Industry-wide Standards including but not limited to:

5. Documentation of Measurement and Control Instruments and Systems (ISA 5)
6. Enterprise/control Integration (ISA 95)
7. Manufacturing and Control Systems Security (ISA 99)

Production/Process Monitoring

8. Calibration and Verification of Analyzers
9. Process/Analyzer Troubleshooting
10. Controlling Sample Flow
11. Documentation and Reporting
12. Environmental Parameters
13. Instrumentation
14. Performance of Analytical Tests
15. Time, Materials, and Costs

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Tier 4 - Industry Wide Technical Competencies

C. Maintenance, Installation, and Repair: Maintain and optimize analyzer technology in support of process or manufacturing equipment and systems.

Critical Work Functions

1. Communicate with others to ensure maintenance and repairs meet operational needs.
2. Coordinate preventive maintenance to ensure production or industrial process runs smoothly.
3. Identify, diagnose, and/or repair analyzer equipment problems.
4. Maintain analyzer equipment, tools, and workstations.
5. Maintain hands-on knowledge of analyzer equipment operations.
6. Support the installation, customization, or upgrading of analyzer equipment.

Technical Content Areas

General Skills

7. Basic Disassembly/Assembly Skills
8. Installation and Calibration of Analyzers
9. Equipment troubleshooting
10. Installation of Parts for Process Analyzers
11. Schematic Drawings, Specification Sheets and Control Diagrams
12. Use of Hand Tools

Maintenance, Installation, and Repair Skills including but not limited to:

13. Electrical/Electronic Systems
14. Pneumatic Systems
15. Mechanical Fastening Systems
16. Piping Operations

Reliability and Maintainability

17. Analysis of Data Charts and Graphs
18. Analysis of Failure Data
19. Basic Reliability Models
20. Documentation Requirements
21. Investigative Techniques

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Tier 4 - Industry Wide Technical Competencies

D. Supply Chain Logistics: Plan and monitor the movement and storage of materials and products in coordination with suppliers, internal systems, and customers.

Critical Work Functions

1. Monitor inventory of supplies, spare parts and consumable materials
2. Requisition supplies, spare parts and consumable materials

Technical Content Areas

Material Handling

3. Automated Material Handling and Distribution Systems
4. Integrated Supply Chain Information Technology

Managing Inventory

5. Inventory Monitoring and Audits
6. Ordering Materials and Supplies

Production Systems

7. Change Orders, Bills of Material, and Work Orders
8. Lead and Cycle Time

Supply-Chain Management

9. Collaborative, Planning, Forecasting, and Replenishment
10. Just-in-Time/Lean Manufacturing
11. Manufacturing Resources Planning
12. Vendor Managed Inventory Systems

Work Flow

13. Material Handling
14. Production Scheduling
15. QA Release

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Tier 4 - Industry Wide Technical Competencies

E. Quality Assurance and Continuous Improvement: Ensure product and process meets quality system requirements as defined by customer specifications.

Critical Work Functions

1. Participate in audits and inspections that maintain the quality and continuous improvement process.
2. Suggest and/or implement continuous improvement actions.
3. Support and maintain quality assurance analyzer systems.
4. Understand and apply basic concepts associated with measuring quality.

Technical Content Areas

Continuous Improvement

5. Benchmarking and Best Practice
6. Data Analysis

Corrective and Preventive Actions

7. Eliminating Non-Conformities
8. Verification, Calibration and Documentation

Improving Quality

9. Sampling and Charting
10. Statistical Process Control Methods – for example; Acceptance Sampling, Inspection/Test/Validation, Reliability Analysis

Quality Assurance

11. Industry Standards
12. Meeting Customer Needs

Quality Assurance Audits

13. Audit Procedures
14. ISO 9000

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Tier 4 - Industry Wide Technical Competencies

F. Health, Safety, Security, and Environment: Equipment, practices, and procedures which promote a healthy, safe, and secure work environment.

Critical Work Functions

1. Comply with local, federal and company health, safety, security, and environmental regulations.
2. Participate in health, safety, and/or environmental incident and hazard investigations.
3. Participate in preventive health, safety, and/or environmental incident and hazard inspections.
4. Ensure that equipment is being used safely.
5. Identify unsafe or insecure conditions and take corrective action.
6. Implement continuous improvement in health, safety, security, and/or environmental practices.
7. Understand and follow established personal safety, security, and environmental practices.

Technical Content Areas

Continuous Improvement in Health, Safety, Security, and Environment

8. Analysis of Health/Safety/Security/Environmental Data
9. Root Cause Analysis

Environmental Protection/Waste Management

10. Chemical Hazard Assessment
11. Operate Analyzers to Minimize Environmental Impact

Investigations for Health, Safety, Security, or Environmental Incidences/Hazards

12. Developing Corrective Actions
13. Documentation of Findings
14. Follow-up Investigation
15. Violations Reports to Proper Authorities

Personal Safety

16. Understanding and Following Established Safety Practices
17. Safety Procedures for the Working Environment
18. Use of Personal Protective Equipment and Clothing

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Tier 5 - Process Analyzer Technical Competencies

Preventive Health, Safety or Environmental Inspections

19. Audit of Records and Documentation
20. Conducting Inspections
21. Documentation of Inspection Findings
22. Emergency Response Preparedness
23. Fire Protection and Control

Regulations

24. Hazardous Material Communication (HAZCOM)
25. Hazardous Material Handling and Disposal (HAZMAT)
26. Hazardous Material Information System Labeling and Storage (HMIS)
27. Office of Homeland Security System and Physical Security Regulations
28. Regulations Governing Safe Use of Equipment
29. Role of the Occupational Safety and Health Administration (OSHA), the Environmental Protection Administration (EPA) or Other Appropriate Regulatory Bodies in the Workplace

Safety Procedures

30. Confined Spaces
31. First Aid or First Response Procedures
32. Assessing Material, Equipment and Fixtures for Hazards
33. Lock /Tag Out Practices
34. Material Safety Data Sheets (MSDS)
35. Response to Shop Emergencies
36. Safe Evacuation of Facility
37. Safe Moving of Materials
38. Safe, Prescribed Operation of Equipment and Tools
39. Use, Maintenance and Inspection of Machine Safeguards
40. Use of Safety Equipment

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Tier 5 - Process Analyzer Technical Competencies

A. Analyzer Fundamentals: Systems, processes, applications, and standards supporting the design and application of analyzers and their support systems.

Critical Work Functions

1. Integrate analyzers in various manufacturing and industrial applications.
2. Recognize emerging and future analyzer technologies.
3. Understand the role of analyzers in industrial processes.
4. Abide by industry codes, standards, and regulations.

Technical Content Areas

Analyzer Project Phases

5. Project Planning
6. Development
7. Detail Design and Procurement
8. Construction
9. Start-up/Commissioning
10. Testing and Validation
11. Maintenance, Troubleshooting, and Repair

Analyzer Equipment including but not limited to:

12. Sample Systems – In-situ, Extracted, Conditioned
13. Composition – Chromatography and Detectors
14. Electrochemical – pH, Conductivity
15. Physical Property – Air Quality, Explosimeters, LELs
16. Spectro-photometric – IR, Tunable Diode Laser

Codes, Standards, and Regulations (as applicable)

17. American National Standards Institute (ANSI)
18. American Petroleum Institute (API)
19. Institute of Electrical and Electronics Engineers (IEEE)
20. International Society of Automation (ISA)
21. International Electro-technical Commission (IEC)
22. National Electrical Code (NEC)
23. National Electrical Manufacturers Association (NEMA)
24. National Fire Protection Association (NFPA)
25. Other Industry-specific Codes, Standards, and Regulations

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Tier 5 - Process Analyzer Technical Competencies

B. Analyses Devices: The sensing, measurement, and analyses devices necessary for analyzer systems.

Critical Work Functions

1. Calibrate, troubleshoot, test, repair, and improve analyses devices.
2. Install wiring to faithfully communicate information from these devices to and from control equipment.
3. Document analyses devices, and communications from these devices.
4. Select, specify, and install devices to manipulate flows, energy, positions, speeds, and other variables to condition samples.
5. Select, specify, and install devices to measure and analyze physical and chemical properties.
6. Efficiently supply reliable, quality power to analyzer systems.

Technical Content Areas

Analytical Instrumentation including but not limited to:

7. Composition – Chromatography and Detectors
8. Electrochemical – pH, Conductivity
9. Physical Property – Air Quality, Explosimeters, LELs
10. Spectro-photometric – IR, Tunable Diode Laser
11. Installation
12. Maintenance – normal repair, replace, clean, etc.
13. Scheduled Preventive Maintenance (PM)

Basic Process Instrumentation

14. Flow
15. Level
16. Pressure
17. Temperature

Electrical Installations

18. Electrical Wiring Details
19. Grounding
20. Power
21. Surge Suppressors
22. Uninterruptible Power Systems (UPS)

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Tier 5 - Process Analyzer Technical Competencies

C. Sampling: Ensuring predictable, stable, and consistent operation at target levels of performance with only minimal variations.

Critical Work Functions

1. Calibrate, troubleshoot, inspect, test, and repair analyzer sample systems.
2. Install and maintain analyzer sample systems.
3. Efficiently supply reliable, quality power to sample systems.

Technical Content Areas

Sample Systems

4. In-situ and Extracted Samples
5. Sample Point Selection
6. Sample Conditioning Systems

Continuous and Process Control

7. Process Characteristics
8. Feedback Control and Tuning
9. Advanced Regulatory Control

Control Equipment

10. Distributed Control Systems: Hardware and Configuration
11. Process Analyzer Controllers: Hardware, Architecture and Communications
12. Programmable Logic Controllers: Hardware and Configuration
13. SCADA Systems: Hardware, Architecture, and Communications

System Documentation

14. Installation Details
15. Instrument Lists
16. Location Plans (Instrument Location Drawings)
17. Logic Diagrams
18. Loop Diagrams
19. Operating Instructions
20. Piping and Instrument Diagrams (P&ID)
21. Process Flow Diagram (PFD)
22. Specification Forms
23. Standards and Regulations

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Tier 5 - Process Analyzer Technical Competencies

Visualization

24. Human Factors
25. Machine Level Interfaces
26. Mobile/Portable
27. Operator Interface - Human Machine Interface (HMI)
28. Enterprise Interfaces - Plant-wide Displays, Dashboards

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Tier 5 - Process Analyzer Technical Competencies

D. Communications, Integration, and Software: Databases, networks, and programming.

Critical Work Functions

1. Install and support the integration of analyzer systems with other systems.
2. Work with databases for analyzer systems

Technical Content Areas

Data Management

3. Data Documentation
4. Data Storage and Retrieval
5. Database Operations and Maintenance
6. Database Structure and Types
7. Special Requirements of Real -Time Process Databases

Industrial Communication Protocols including but not limited to:

8. Ethernet-TCP/IP
9. Foundation Fieldbus
10. HART
11. Modbus
12. PROFIBUS
13. PROFINET

Network Configuration

14. Cable (Wire and Fiber Optic) Networks
15. Wireless Networks

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Tier 5 - Process Analyzer Technical Competencies

E. Process and Equipment Safety: Analyzer system safety and reliability.

Critical Work Functions

1. Analyze and determine the need for design changes or additional equipment to improve safety.
2. Apply instrumentation or analyzer procedures in hazardous areas safely.
3. Install, validate, periodically check, and maintain the safety equipment.
4. Determine the appropriate tools and methods.

Technical Content Areas

Alarm Management

5. Alarm Management System
6. Key Components of an Alarm Philosophy

Analyzer Shelters

7. Shelter Concepts
8. Design Considerations
9. Laws and Regulations
10. Protection Levels
11. Risk Analysis

Manufacturing/Process Safety

12. Hazard and Risk Analysis including Hazard and Operability (HAZOP) Studies
13. Process Safety Management Standard (PSM)
14. Safety Requirements Specification
15. Installation, Commissioning, and Validation
16. Operations and Maintenance

Reliability

17. Common Cause and Its Impact on Reliability
18. Concepts of Mean Time to Repair (MTTR), Mean time to Failure (MTTF) and Mean Time Between Failures (MTBF)

Safe Use and Application of Electrical Apparatus

19. Equipment for Use Where Explosive Concentrations of Gas, Vapor, or Dust Might be Present
20. Installation for Hazardous Areas
21. General Purpose Requirements

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Tier 5 - Process Analyzer Technical Competencies

Safety Controller Equipment

22. General Purpose Programmable Logic Controllers (PLCs)
23. Safety PLCs
24. Diagnostic Annunciation

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Resources Reviewed

The Analyzer Technician Competency Model framework follows the work completed by the Automation Federation in partnership with the Department of Labor to develop the broad industry based Automation Competency Model. By using the Automation Competency Model as a base, process industry and analyzer subject matter experts were able to start with a nationally validated model especially applicable at the foundational levels and to the profession as a whole. The resources reviewed in developing the Automation Competency Model included:

- ***Automation Body of Knowledge,*** ISA
- ***Automation Control Systems Course Syllabus,*** Chattanooga State Technical Community College
- ***Automation Engineering Technology Curriculum Standard,*** North Carolina Community College System
- ***Automation Federation Workforce Development Policy,*** Automation Federation
- ***Automation, Robotics, and Controls/Instrumentation Austin Competency Analysis Profile,*** Austin Community College
- ***Industrial Engineering Technicians Occupation Report,*** O*NET Online
- ***Industrial Instrumentation and Controls Technician Skill Standards,*** Industrial Instrumentation and Controls Technology Alliance (IICTA)
- ***Industrial Production Managers Occupation Report,*** O*NET Online
- ***The Influence of Manufacturing Facility Demographics on Manufacturing Competencies in North Carolina,*** Richard Temple, Western Carolina University
- ***ISA Automation Engineering Degree Program,*** ISA
- ***ISA Career Library,*** ISA
- ***ISA Certified Automation Professional Body of Knowledge,*** ISA
- ***ISA Certified Control Systems Technician Body of Knowledge,*** ISA
- ***ISA Certified Industrial Mechanic Body of Knowledge,*** ISA
- ***ISA Control Systems Technician Associate Degree Program,*** ISA
- ***ISA Education and Training,*** ISA
- ***ISA Standards,*** ISA
- ***ISA Training Catalog,*** ISA
- ***Manufacturing/Automation Skill Standards,*** Texas Skill Standards Board
- ***Robotics and Automation Technology Vocational Technical Education Framework,*** Massachusetts Department of Education
- ***Society of Manufacturing Engineers Certifications,*** Society of Manufacturing Engineers

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Analyzer Technician Competency Model

The Analyzer Technician Competency Model modifies the broad industry Automation Model to be an occupation specific model. Many of the same resources were reviewed with emphasis on:

- ***Manufacturing Career Cluster Knowledge and Skills for Installers, Maintenance and Repair, and Quality Assurance Career Pathways,*** Manufacturing Skill Standards Council
- ***Skill Standards for Control System Technicians,*** ISA
- ***Skill Standards for Industrial Instrumentation and Control Technicians,*** Texas Skill Standards Board

Development of the Analyzer Technician Competency Model began in April of 2007. The initial panel of eight subject matter experts from refining, petrochemical, chemical and equipment suppliers included representatives of Lyondell Refining, Bayer Corporation, DuPont, ExxonMobil Plastics, ExxonMobil Refinery and Chemical, GE Sensing, and Valero. The panel provided data to identify occupation specific tasks, skills and educational requirements for math, science and analyzer technical knowledge required to perform well on the job. Several face-to-face meetings followed with members of national and regional instrumentation professional organizations to refine a complete first draft of the Analyzer Technician Competency Model.

A validation survey of the draft Analyzer Technician Competency Model was conducted from February through May, 2009. Analyzer technicians, members of the ISA Analysis Division and other professionals representing small and large company sites, and many different industries were contacted nationally to validate the elements of the competency model. Their collective comments are represented in this final release of the model.

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