

# **Plastics Education Consortium CORE SKILLS ANALYSIS Summary Report**

Manufacturing Specialist  
OATC, Wilsonville, Oregon  
February 7, 2000

## **Executive Summary:**

This Core Skills Analysis was completed for the occupation of manufacturing technician in the plastics industry. The purpose was to validate, expand and enhance the identified core competencies common to similar positions in other high-performance manufacturing organizations. Duties for this position include supporting product design, production systems and manufacturing processes; monitoring and maintaining production equipment, personnel and resources; performing production and administrative duties; and supporting and maintaining safety and quality standards of the company.

The participants reviewed an initial draft of ten core manufacturing functions, 80 related tasks, technical knowledge requirements, and employability skills, drawn from research incorporating at least six core standards and competencies in related industries. This matrix was edited, expanded, revised, and reordered to ten core functions and 61 tasks, including some that were specific to the plastics manufacturing industry. In addition, four of the eight ACT Work Keys skill areas were reviewed, and participants identified the levels required for both entry and effective performance of the job. Those skills were (ranked in order of criticality to the occupation): Applied Technology, Observation, Locating Information, and Applied Mathematics. The tasks were also reviewed for Relative Time Spent and Relative Importance, and were ranked in criticality to the industry by the participants.

On Monday, February 7, 2000, six former and current manufacturing technicians from the local plastics industry gathered in a meeting room at the OATC in Wilsonville for the eight-hour process. The companies represented included: R & D Plastics, Puget Plastics, Nypro Oregon, Vision Plastics, JAE Oregon, and Plastics Development (PDI). In addition, two observers were present for part or all of the session: Bonnie Starkey of Portland Community College, who conducted pre-focus group interviews with industry representatives; and Candace Trotter of Vision Plastics, who served as the coordinating staff for the project on behalf of the PEC. The Core Skills Analysis was conducted by Laura Tonkin from The Mackey Group, Seattle, WA, and Eileen Casey White from Chemeketa Community College's Training & Economic Development Center.

## **Summary Information and Next Steps:**

Attached are the Core Skills Analysis results, summarized by job function and expanded in a matrix format. Also included is a summary report of the ACT Work Keys component, with skill levels and descriptions determined by the participants and the 61 tasks ranked from most to least critical. Because of the diverse nature of processing and practices represented by the companies participating in this skills validation and analysis, the ranking may not directly apply to any one company. Rather, it is designed to give a broader understanding of the nature of the work and the general expectations of

the plastics industry for the occupation of manufacturing specialist.

Several new opportunities and some enhancement of existing partnerships have emerged as a result of this core skills analysis:

- These results are being forwarded to the Plastics Education Consortium for inclusion in their curriculum and skills testing alignment projects.
- Several companies in related industries who have participated in similar validation studies have requested the matrix for use in further discussions of job descriptions, reorganization, and responsibilities that cross industry specialties.
- Several Oregon community colleges have begun work on aligning their current curricula in high-performance manufacturing programs with these emerging cross-industry skills and standards.
- This matrix of core competencies will be used in validation with other high-performance, high-tech industries in Oregon, in order to ensure more effective worker preparation and cross-training.

## **Tasks Ranked by Criticality**

1. Analyzes and troubleshoots process related problems.
2. Operates, monitors, and adjusts controls to eliminate defects.
3. Monitors and processes output parameters.
4. Ensures manufacturing system meets quality system requirements.
5. Maintains accurate records and logs of modifications, calibrations, and adjustments.
6. Uses company problem-solving systems to continuously improve manufacturing operations.
7. Uses standard improvement tools to define problems, identify possible causes, and evaluate causes and potential solutions.
8. Positions, aligns, and secures assembled mold, components, and accessories.
9. Evaluates and records performance of production tool set.
10. Inspects in-process product.
11. Operates and controls equipment through continuous monitoring.
12. Participates in product experiments to find source of process problems to optimize process limits.
13. Performs communication at time of shift change.
14. Records process data such as flow rates and parts changes.
15. Troubleshoots and diagnoses equipment and machines.
16. Evaluates performance of production system.
17. Inspects, adjusts, cleans or aligns equipment and machines.
18. Participates in design of experiments to find source of process problems to optimize process limits.
19. Performs training and certification of new employees.
20. Provides feedback information on prototype processes and products.
21. Recommends improvements in design of production system.
22. Sets-up, recalculates, and cleans equipment and machine difficulties.
23. Assists in maintenance of quality records.
24. Collects and reports on experimental data.
25. Interprets and clarifies customer expectations.
26. Monitors production flow.
27. Reviews and documents specifications and makes recommendations.
28. Assists in calibration and set-up of equipment and machines.
29. Maintains molds, dies, and product samples.
30. Obtains customer specifications.
31. Performs preventative maintenance on molds/dies.

32. Communicates with internal customer to confirm specifications and requirements.
33. Conducts periodic internal compliance review of tool set.
34. Monitors fabrication equipment.
35. Develops work instructions.
36. Ensures manufacturing system meets health and safety requirements.
37. Modifies process plans for producing product.
38. Reviews quality policies, and reviews and updates procedures and work instructions.
39. Inspects, measures, and tests end product.
40. Makes modifications to equipment and machines to optimize performance.
41. Conducts periodic internal compliance reviews.
42. Ensures manufacturing system meets environmental management requirements.
43. Maintains and adjusts production plans and schedules to meet customer requirements.
44. Assists in team development and performance reviews.
45. Develops, manages, and improves preventative maintenance plans.
46. Ensures clean room protocol is maintained.
47. Maintains certification and licensure.
48. Performs emergency shutdown procedures.
49. Performs preventative maintenance.
50. Sets performance standards and assists in hiring process.
51. Assists in chemical handling and housekeeping.
52. Assists in audits by customers and ISO.
53. Assists in routine low volume processing of product.
54. Cleans and replaces supply items utilized during manufacturing of product.
55. Mixes product materials and fills hoppers.
56. Monitors maintenance activities.
57. Performs light wiring using logic and schematic diagrams.
58. Prepares purchase reports, work requests, and reports.
59. Builds jigs and fixtures.
60. Reclaims, recycles, or disposes of waste product.
61. Trims, buffs, and polishes product.



## Work Keys Profile

Occupational Title: **Manufacturing Specialist**

Profile Date: **02/07/00**

Total Number of Companies Represented: **6**

Total Number of Subject Matter Experts (SMEs): **6**

Skill	Entry Level	Performance Level	Range
Applied Mathematics	5-6	6-7	3-7
Observation	5	5	3-6
Locating Information	4-5	5-6	3-6
Applied Technology	4-5	5-6	3-6

Briefly, profiling an occupation involved the following four steps:

1. Developing a list of the most critical tasks to the occupation;
2. Identifying the tasks associated with each Work Keys skill;
3. Identifying on-the-job behaviors associated with each skill as it is used on the job; and
4. Determining the Work Keys skills levels of the occupation.

As the initial step, subject matter experts (SMEs), consisting of employees identified by your organization as having firsthand knowledge of the requirements of the occupation, reviewed the task and functions for relevance and comprehensiveness. The SMEs rated each task on both IMPORTANCE (i.e., the significance of the task to overall job performance) and RELATIVE TIME SPENT (i.e., the amount of time spent performing this task compared with that spent on other tasks). The CRITICALITY of each task to the occupation (the multiplication of IMPORTANCE and RELATIVE TIME SPENT) was then calculated. The SMEs reviewed the list of tasks and their CRITICALITY ratings and revised the list so that only the most critical tasks remained.

Using this list of the most critical tasks, the SMEs discussed how the Work Keys skills (i.e., Applied Mathematics, Locating Information and Applied Technology) were required for performance of each task, and then identified the tasks associated with each skill (task could be associated with more than one skill). Guided by these new lists, the SMEs identified on-the-job behaviors and activities that required a particular skill, such as reading manuals, calculating the sum of a list of numbers, etc. Finally, the SMEs reviewed the descriptions of the Work Keys skills to determine the levels needed to perform the tasks of the occupation.

The resulting occupational profile as determined by the SMEs is presented in the table at the top of this page. The most critical tasks and a description of the Work Keys skills levels for this occupation are presented on the following pages.

## Skill Level Descriptions

### **Applied Mathematics      Level: 5**

Employees are required to:

- < look up a formula and change from one unit to another unit of measurement within a system of measurement (e.g., from ounces to pounds) or between systems of measurements (e.g., from centimeters to inches).
- < calculate using mixed units (e.g., 3.50 hours and 4 hours 30 minutes).
- < do several steps of logic and calculations, including division of negative numbers.
- < decide what information, calculations, or unit conversions are needed to find a solution.
- < determine the best deal.

For example, employees may be required to calculate perimeters and areas of basic shapes (e.g., rectangles and circles), to calculate percent discounts or markups, to compare costs to determine which is the best deal, or to complete a balance sheet or order form that requires several math operations (e.g., total an order, and then calculate tax and shipping costs).

### **Applied Mathematics      Level: 6**

Employees are required to:

- < set up problems and do several steps of calculations or conversions.
- < calculate using negative numbers, fractions, ratios, percentages, or mixed numbers (e.g.,  $12 \frac{1}{8}$ ).
- < transpose a formula before calculating (e.g.,  $8X = 20 \Rightarrow X = 20/8$ ).
- < look up and use two formulas to change from one unit to another unit within the same system of measurement (e.g., 1 cup = 8 fl oz, 1 quart = 4 cups).
- < find mistakes in calculations, such as those required in lower levels.
- < determine the best deal and perform a further calculation with the result.

For example, employees may be required to calculate multiple rates, to find areas of rectangles and volumes of rectangular solids, or to solve problems that compare production rates and pricing schemes.

### **Applied Mathematics      Level: 7**

Employees are required to:

- < do several steps of reasoning and calculations.
- < solve problems involving more than one unknown, and nonlinear functions (e.g., rate of change).
- < find mistakes in multiple-step calculations.
- < figure out the information needed to solve a problem when the information presented is incomplete or implicit.

For example, employees may be required to convert between systems of measurement that involve fractions, mixed numbers, decimals, or percentages; to calculate multiple areas and volumes of spheres, cylinders, or cones; to set up and manipulate complex ratios or proportions; or determine the better economic value of several alternatives.

## **Locating Information      Level: 4**

Employees must read straightforward workplace graphics, such as basic order forms, line graphs, standard tables, basic diagrams, flowcharts, instrument gauges, and maps.

Employees are required to:

- < find several pieces of information in these types of graphics.
- < summarize and/or compare information and trends in a single graphic.
- < summarize and/or compare information and trends among more than one workplace graphic, such as a bar chart and a table showing related information.

## **Locating Information      Level 5**

Employees must read complicated workplace graphics, such as detailed forms, tables, graphs, diagrams, instrument gauges, and maps.

Employees are required to:

- < summarize and/or compare information and trends in a single graphic.
- < summarize and/or compare information and trends among more than one workplace graphic, such as a bar chart and a table showing related information.

## **Locating Information      Level: 6**

Employees must read complex workplace graphics containing large amounts of information and/or challenging presentations. These graphics include very detailed graphs, charts, tables, forms, maps, and diagrams.

Employees are required to:

- < make decisions, draw conclusions, and/or make predictions requiring judgements based on the information presented in the graphics.
- < apply information to specific situations using one complex graphic or several related graphics.

## **Applied Technology      Level: 4**

Employees must be able to solve problems involving a moderately complex system or the interaction of two or more simple systems. While all the information employees need to solve the problems is available, some extraneous information is also included. In addition, solutions may involve changing two variables at the same time.

In solving these problems, employees must:

- < understand the operation of moderately complex tools, machines, and systems, such as small appliances, pulley-driven equipment, or piping systems that carry more than one fluid.
- < apply the more abstract and less intuitive elementary principles underlying the operation of physical systems to the solutions of work-related problems, such as heat transfer or electric current.
- < determine the meaning of some technical terms defined within the context of a problem.
- < identify information relevant to solving problems (two variables) & disregard extraneous information.
- < eliminate several physical symptoms as the potential source of a problem or identify the best solution after eliminating other possibilities.

## **Applied Technology      Level: 5**

Employees are required to solve problems involving a complex system which consists of more components and performs more complex operations than that found at Level 4, or those involving one or more simple tools or systems which interact. These problems present more extraneous information and include more jargon than problems at Level 4. In additions, solutions may involve changing two or three variables at the same time.

In solving these problems, employees must:

- < understand the operation of complex machines and systems, such as gasoline engines, complex appliances, and building electrical systems.
- < apply moderate and advanced principles of mechanics, electricity, thermodynamics, and fluid dynamics to the solutions of work-related problems, such as phase change (e.g., from gas to liquid) or pressure equilibrium in a system.
- < apply prior knowledge of systems and testing procedures (e.g., operation of ohmmeter).
- < identify information relevant to solving a problem (two to three variables) and disregard extraneous information.
- < eliminate several physical symptoms as the potential source of a problem or identify the best solution after eliminating other competing possibilities.

## **Applied Technology      Level: 6**

Employees are required to solve problems involving one or more tools or systems across a range of complexity. These problems present a moderate to heavy volume of information. In addition, they present a variety of potential sources of problems related to the system(s) that are subtle and difficult to diagnose.

In solving these problems, employees must:

- < apply principles that affect certain properties of a system, such as the application of the gas law in an air-conditioner.
- < apply one or more principles of mechanics, electricity, thermodynamics, or fluid dynamics interacting in complex systems,
- < form and test numerous hypotheses to ensure that the problem is diagnosed correctly (troubleshoot) in complex systems in which a variety of mechanical, electrical, thermal, or flow faults

- are potential sources of difficult problems.
- < choose the appropriate tool or piece of diagnostic equipment to accomplish a task.

**Observation            Level: 5**

Employees must pay attention to and remember work procedures that involve several tasks which may occur at the same time and/or outside the employee's control. Tasks are performed at a moderate pace, often interact with each other, and may change from one situation to another. The employee must examine differences and figure out if the differences are important to note (e.g., detect differences from standards and figure out if the differences are big enough to report). There are often several extra details and/or distractions that may make it difficult for the employee to pay attention to the important elements.

Employees are required to:

- < focus attention on and remember several important details from a complex series of events that may occur at the same time.
- < pay attention to details that are presented at a moderate pace.
- < maintain attention to detail with little prompting.
- < ignore irrelevant background information or distractions by only paying attention to important points.
- < recognize several differences presented at the same time or examine a subtle difference to judge if it is an acceptable difference.