

Standard Costing



LEARNING OBJECTIVES

After completing this chapter, you should be able to answer the following questions:

1

Why are standard cost systems used?

2

How are standards for material, labor, and overhead set?

3

What documents are associated with standard cost systems and what information do those documents provide?

4

How are material, labor, and overhead variances calculated and recorded?

5

What are the benefits organizations derive from standard costing and variance analysis?

6

How will standard costing be affected if a company uses a single conversion element rather than the traditional labor and overhead elements?

7

(Appendix) How do multiple material and labor categories affect variances?

<http://www.commerceonline.com>

Let's face it: Almost no one likes banks. If it isn't the fees, it's the long lines or the short hours or the surly tellers.

Now, walk into any branch of Commerce Bancorp, a community lender based in Cherry Hill, New Jersey: Free checking. Free money orders. Weekday teller service from 7:30 in the morning to 8 at night. And branch service with real tellers on weekends and holidays—even a few hours on Sunday.

Commerce takes the basic service and branding concepts found at fast-food giants—right down to the big red “C” in front of each branch, evoking the golden arches—and applies them to its branches. It keeps long hours. It moves teller lines by reducing many teller functions to one-touch keystrokes, making deposit receipts almost as easy as supersizing an Extra Value Meal. It even has bathrooms in each branch. Is this any way to run a bank in the year 2000?

Yes, says Vernon W. Hill II, the founder, president and chairman of Commerce—who is 55 and also owns a string of Burger King outlets. At a time when polls suggest service in America is hitting all time lows—not just at banks, but at telephone companies, airlines and department stores, too—Mr. Hill is showing that good service can be good business.

Commerce wants to be a growth retailer such as Nordstrom or Starbucks. It will open 30 branches this year, bringing its total to about 150, and no other bank

comes close to that rate of openings. “Great retailers get great not by buying somebody and trying to fix them,” says Mr. Hill, waving a copy of “Built from Scratch,” the Home Depot corporate history. “Great retailers get great by developing a model and using it to grow.”

America's rush into the suburbs was in full swing in 1967 when Mr. Hill graduated from the University of Pennsylvania's Wharton School. He settled in southern Jersey, where towns burgeoned with refugees from the surrounding cities of Philadelphia, Trenton, N.J., and Wilmington, Del. American strip culture was booming, and Mr. Hill formed a property company that tapped the torrid growth by developing roadside outlets for retailers.

One of his biggest customers was McDonald's. Fast-food outlets are built to strict specifications covering the outside and interior of each unit. Mr. Hill copied them in 1973, when he kept a promise to his banker father and launched his own bank with a branch in Marlton, N.J. That was the first of dozens of branches he would build and operate during the next two decades.

Today, Mr. Hill still builds all his own branches to look like burger joints. Besides the ubiquitous “C” signs, each has the same open, glass-heavy architecture, the same red-black-and-gray design, the same carpet, desks and blinds. He believes this sends a message of consistent, dependable service. “A Home Depot is a Home Depot no matter where you go,” he says.

SOURCE: Jathon Sapsford, “Local McBanker: A Small Chain Grows by Borrowing Ideas from Burger Joints—Jersey's Commerce Bancorp Stretches Hours, Cuts Fees to Build Volume—The Catch: Lower Interest,” *The Wall Street Journal* (May 17, 2000), p. A1. Permission conveyed through Copyright Clearance Center.

The adoption of retail chain store strategies in banking has allowed Commerce Bancorp to implement a unique banking strategy—standardized service delivered at low cost. Because the bank has a high volume of repetitive transactions, it can develop standards for costs and other performance criteria to ensure consistent service.¹ Cost accountants can provide feedback to managers by comparing dimensions of actual service to predetermined measures. Without a predetermined performance measure, there is no way to know what level of performance is expected. And, without making a comparison between the actual result and the predetermined measure, there is no way to know whether expectations were met and no way for managers to exercise control.

<http://www.burgerking.com>

<http://www.nordstrom.com>

<http://www.starbucks.com>

<http://www.mcdonalds.com>

<http://www.homedepot.com>

¹ For instance, in 1999 Commerce had 3.9 million teller transactions, 1.5 million ATM transactions, and 1.1 million check card transactions. SOURCE: Jathon Sapsford, “Local McBanker: A Small Chain Grows by Borrowing Ideas from Burger Joints—Jersey's Commerce Bancorp Stretches Hours, Cuts Fees to Build Volume—The Catch: Lower Interest,” *The Wall Street Journal* (May 17, 2000), p. A1.

Organizations develop and use standards for almost all tasks. For example, businesses set standards for employee sales expenses; hotels set standards for housekeeping tasks and room service delivery; casinos set standards for revenue to be generated per square foot of playing space. Because of the variety of organizational activities and information objectives, no single performance measurement system is appropriate for all situations. Some systems use standards for prices, but not for quantities; other systems (especially in service businesses) use labor, but not material, standards.

This chapter discusses a traditional standard cost system that provides price and quantity standards for each cost component: direct material (DM), direct labor (DL), and factory overhead (OH). Discussion is provided on how standards are developed, how variances are calculated, and what information can be gained from detailed variance analysis. Journal entries used in a standard cost system are also presented. The appendix expands the presentation by covering the mix and yield variances that can arise from using multiple materials or groups of labor.

DEVELOPMENT OF A STANDARD COST SYSTEM

1

Why are standard cost systems used?

standard cost

Although standard cost systems were initiated by manufacturing companies, these systems can also be used by service and not-for-profit organizations. In a standard cost system, both standard and actual costs are recorded in the accounting records. This dual recording provides an essential element of cost control: having norms against which actual operations can be compared. Standard cost systems make use of **standard costs**, which are the budgeted costs to manufacture a single unit of product or perform a single service. Developing a standard cost involves judgment and practicality in identifying the material and labor types, quantities, and prices as well as understanding the kinds and behaviors of organizational overhead.

A primary objective in manufacturing a product is to minimize unit cost while achieving certain quality specifications. Almost all products can be manufactured with a variety of inputs that would generate the same basic output and output quality. The input choices that are made affect the standards that are set.

Some possible input resource combinations are not necessarily practical or efficient. For instance, a work team might consist only of craftsmen or skilled workers, but such a team might not be cost beneficial if there were a large differential in the wage rates of skilled and unskilled workers. Or, although providing high-technology equipment to an unskilled labor population is possible, to do so would not be an efficient use of resources, as indicated in the following situation:

A company built a new \$250 million computer-integrated, statistical process controlled plant to manufacture a product whose labor cost was less than 5% of total product cost. Unfortunately, 25% of the work force was illiterate and could not handle the machines. The workers had been hired because there were not enough literate workers available to hire. When asked why the plant had been located where it was, the manager explained: "Because it has one of the cheapest labor costs in the country."²

Once management has established the desired output quality and determined the input resources needed to achieve that quality at a reasonable cost, quantity and price standards can be developed. Experts from cost accounting, industrial engineering, personnel, data processing, purchasing, and management are assembled to develop standards. To ensure credibility of the standards and to motivate people to operate as close to the standards as possible, involvement of managers and workers whose performance will be compared to the standards is vital. The discussion of the standard setting process begins with material.

² Thomas A. Stewart, "Lessons from U.S. Business Blunders," *Fortune* (April 23, 1990), pp. 128, 129.

Material Standards

The first step in developing material standards is to identify and list the specific direct materials used to manufacture the product. This list is often available on the product specification documents prepared by the engineering department prior to initial production. In the absence of such documentation, material specifications can be determined by observing the production area, querying of production personnel, inspecting material requisitions, and reviewing the cost accounts related to the product. Three things must be known about the material inputs: types of inputs, quantity of inputs used, and quality of inputs used. The accompanying News Note indicates how standards can be developed for a private club.

In making quality decisions, managers should seek the advice of materials experts, engineers, cost accountants, marketing personnel, and suppliers. In most cases, as the material grade rises, so does cost; decisions about material inputs usually attempt to balance the relationships of cost, quality, and projected selling prices with company objectives. The resulting trade-offs affect material mix, material yield, finished product quality and quantity, overall product cost, and product salability. Thus, quantity and cost estimates become direct functions of quality decisions. Given the quality selected for each component, physical quantity estimates of weight, size, volume, or some other measure can be made. These estimates can be based on results of engineering tests, opinions of managers and workers using the material, past material requisitions, and review of the cost accounts.

Specifications for materials, including quality and quantity, are compiled on a **bill of materials**. Even companies without formal standard cost systems develop bills of materials for products simply as guides for production activity. When converting quantities on the bill of materials into costs, allowances are often made for normal waste of components.³ After the standard quantities are developed,

2

How are standards for material, labor, and overhead set?

bill of material

GENERAL BUSINESS



NEWS NOTE

Chef Provides Menu for Cost Control

Although some private clubs have attempted to fully computerize their purchasing and inventory operations to accurately measure food and beverage costs, only a few have succeeded. Most have found that the cost of additional technology and staff needed to process all purchases through the system, maintain perpetual inventory information, handle requisitions and transfers for all items, update ingredient costing and recipes, and analyze computer-generated data outweighs the potential cost savings derived from full automation.

Many other factors can also get in the way of accurately measuring food and beverage costs at a private club. Banquets and special club events, buffets, employee meals, wine by the glass, variable bartender pours, yield factors, and waste all combine to make the derivation of an accurate food cost percentage almost impossible in a small operation. And in the world of food and beverage, club volumes are generally very small.

There just isn't enough sales volume to justify sophisticated and costly measurement. But members still want the information.

To satisfy member requests, partial computerization can provide valuable data with a minimal investment. Most commonly this is achieved through the use of a "standard cost" module in the POS (point of sale) system. Simply put, the menu is costed by the chef, costs are assigned to each menu item (along with the price), and cost margin reports are produced with a theoretical food cost for each item, menu group, and dining area, by meal period and range of dates. This simplified plan can be an effective method of measuring menu item costs and sales margins.

SOURCE: William A. Boothe, Jr., "Taking a New Approach to Information Management for Clubs: Part III of III," *Club Management* (St. Louis, May/June 1998), pp. 101–107.

³ Although such allowances are often made, they do not result in the most effective use of a standard cost system. Problems arising from their inclusion are discussed later in this chapter.

prices for each component must be determined. Prices should reflect desired quality, quantity discounts allowed, and freight and receiving costs. Although not always able to control prices, purchasing agents can influence prices. These individuals are aware of alternative suppliers and attempt to choose suppliers providing the most appropriate material in the most reasonable time at the most reasonable cost. The purchasing agent also is most likely to have expertise about the company's purchasing habits. Incorporating this information in price standards should allow a more thorough analysis by the purchasing agent at a later time as to the causes of any significant differences between actual and standard prices.

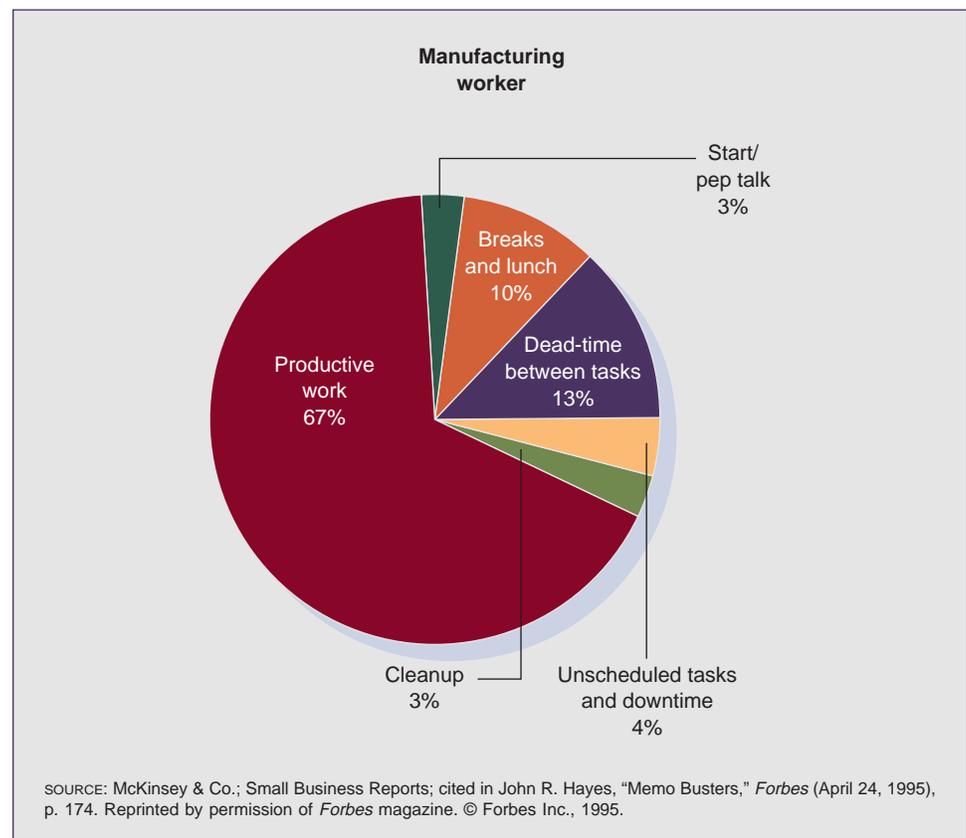
When all quantity and price information is available, component quantities are multiplied by unit prices to obtain the total cost of each component. (Remember, the price paid for the material becomes the cost of the material.) These totals are summed to determine the total standard material cost of one unit of product.

Labor Standards

Development of labor standards requires the same basic procedures as those used for material. Each production operation performed by either workers (such as bending, reaching, lifting, moving material, and packing) or machinery (such as drilling, cooking, and attaching parts) should be identified. In specifying operations and movements, activities such as cleanup, setup, and rework are considered. All unnecessary movements by workers and of material should be disregarded when time standards are set. Exhibit 10-1 indicates that a manufacturing worker's day is not spent entirely in productive work.

EXHIBIT 10-1

Where Did the Day Go?





Although standards are commonly thought of as being used in manufacturing situations, many service businesses determine staffing levels based on the standard labor time needed to help a customer. Additionally, Intercity's train schedules are based on the standard time to go from point to point.

To develop usable standards, quantitative information for each production operation must be obtained. Time and motion studies may be performed by the company; alternatively, times developed from industrial engineering studies for various movements can be used.⁴ A third way to set a time standard is to use the average time needed to manufacture a product during the past year. Such information can be calculated from employees' past time sheets. A problem with this method is that historical data may include inefficiencies. To compensate, management and supervisory personnel normally make subjective adjustments to the available data.

After all labor tasks are analyzed, an **operations flow document** can be prepared that lists all operations necessary to make one unit of product (or perform a specific service). When products are manufactured individually, the operations flow document shows the time necessary to produce one unit. In a flow process that produces goods in batches, individual times cannot be specified accurately.

Labor rate standards should reflect the employee wages and the related employer costs for fringe benefits, FICA (Social Security), and unemployment taxes. In the simplest situation, all departmental personnel would be paid the same wage rate as, for example, when wages are job specific or tied to a labor contract. If employees performing the same or similar tasks are paid different wage rates, a weighted average rate (total wage cost per hour divided by the number of workers) must be computed and used as the standard. Differing rates could be caused by employment length or skill level.

Overhead Standards

Overhead standards are simply the predetermined factory overhead application rates discussed in Chapters 3 and 4. To provide the most appropriate costing information, overhead should be assigned to separate cost pools based on the cost drivers, and allocations to products should be made using different activity drivers.

⁴ In performing internal time and motion studies, observers need to be aware that employees may engage in "slowdown" tactics when they are being clocked. The purpose of such tactics is to establish a longer time as the standard, which would make employees appear more efficient when actual results are measured. Or employees may slow down simply because they are being observed and want to be sure they are doing the job correctly.

operations flow document

3

What documents are associated with standard cost systems and what information do those documents provide?

standard cost card

After the bill of materials, operations flow document, and predetermined overhead rates per activity measure have been developed, a **standard cost card** is prepared. This document (shown in Exhibit 10–2) summarizes the standard quantities and costs needed to complete one product or service unit.

Data for Parkside Products are used to illustrate the details of standard costing.⁵ Parkside manufactures several products supporting outdoor recreation including an unassembled picnic table. The bill of materials, operations flow document, and standard cost card for the picnic table appear, respectively, in Exhibits 10–2 through 10–4.

For ease of exposition, it is assumed that the company applies overhead using only two companywide rates: one for variable overhead and another for fixed overhead.

Data from the standard cost card are then used to assign costs to inventory accounts. Both actual and standard costs are recorded in a standard cost system, although it is the standard (rather than actual) costs of production that are debited to Work in Process Inventory.⁶ Any difference between an actual and a standard cost is called a variance.

EXHIBIT 10-2

Parkside Products' Bill of Materials for Picnic Table

Product: Picnic Table			
Product # 017			
Date Established: June 30, 2000			
COMPONENT ID#	QUANTITY REQUIRED	DESCRIPTION	COMMENTS
L-04	2	2" × 6" × 12'	Pressure treated
L-07	1	2" × 10" × 12'	Pressure treated
P-13	2	Tubular frame	Predrilled red/green finish
P-19	16	2.5" × 5/16" bolts	Includes nuts and flat washers
P-21	8	5" × 3/8" bolts	Includes nuts and flat washers
F-33	1 pint	Oil-based paint	Red or green
P-100	1	1-Gallon zippable plastic bag	For packaging bolts
I-09	1	Assembly instructions	18 Pages w/pictures

⁵ Data for the picnic table illustration are adapted from: Michael Umble and Elizabeth J. Umble, "How to Apply the Theory of Constraints' Five-Step Process of Continuous Improvement," *Journal of Cost Management* (September/October 1998), pp. 4–14.

⁶ The standard cost of each cost element (direct material, direct labor, variable overhead, and fixed overhead) is said to be applied to the goods produced. This terminology is the same as that used when overhead is assigned to inventory based on a predetermined rate.

EXHIBIT 10-4

Parkside Products' Standard
Cost Card for Picnic Table

Product: Picnic Table								
Product # 017								
Date Established: June 30, 2000								
DIRECT MATERIAL								
ID#	Unit Price	Total Quantity						Total Cost
L-04	\$4.00	2						\$ 8.00
L-07	8.00	1						8.00
P-13	7.00	2						14.00
P-19	0.05	16						0.80
P-21	0.10	8						0.80
F-33	1.20	1						1.20
P-100	0.20	1						0.20
I-09	3.00	1						3.00
Total direct material cost							<u>\$36.00</u>	
DIRECT LABOR								
ID#	Avg. Wage Rate per Minute	Total Minutes	DEPARTMENT					Total Cost
			Cutting	Drilling	Sanding	Finishing	Packaging	
009	\$0.40	3	\$1.20					\$ 1.20
009	0.40	3	1.20					1.20
017	0.40	2	0.80					0.80
017	0.40	2	0.80					0.80
042	0.30	4		\$1.20				1.20
048	0.30	4		1.20				1.20
079	0.35	18			\$6.30			6.30
093	0.45	4				\$1.80		1.80
067	0.25	5					\$1.25	1.25
Totals for direct labor			<u>\$4.00</u>	<u>\$2.40</u>	<u>\$6.30</u>	<u>\$1.80</u>	<u>\$1.25</u>	<u>\$15.75</u>
MANUFACTURING OVERHEAD								
Variable overhead (\$24 per labor hour) (45 DL minutes)							\$18.00	
Fixed overhead (\$15 per unit produced)*							15.00	
Total overhead							<u>\$33.00</u>	
*Based on expected annual production of 6,000 units.								

A price variance reflects the difference between what was paid for inputs and what should have been paid for inputs. A usage variance shows the cost difference between the quantity of actual input and the quantity of standard input allowed for the actual output of the period. The quantity difference is multiplied by a standard price to provide a monetary measure that can be recorded in the accounting records. Usage variances focus on the efficiency of results or the relationship of input to output.

The diagram moves from actual cost of actual input on the left to standard cost of standard input quantity on the right. The middle measure of input is a

hybrid of actual quantity and standard price. The change from input to output reflects the fact that a specific quantity of production input will not necessarily produce the standard quantity of output. The far right column uses a measure of output known as the **standard quantity allowed**. This quantity measure translates the actual production output into the standard input quantity that should have been needed to achieve that output. The monetary amount shown in the right-hand column is computed as the standard quantity allowed times the standard price of the input.

standard quantity allowed

The price variance portion of the total variance is measured as the difference between the actual and standard prices multiplied by the actual input quantity:

$$\text{Price Element} = (\text{AP} - \text{SP})(\text{AQ})$$

The usage variance portion of the total variance is measured as measuring the difference between actual and standard quantities multiplied by the standard price:

$$\text{Usage Element} = (\text{AQ} - \text{SQ})(\text{SP})$$

The following sections illustrate variance computations for each cost element.

MATERIAL AND LABOR VARIANCE COMPUTATIONS

The standard costs of production for January 2001 for producing 400 picnic tables (the actual number made) are shown in the top half of Exhibit 10–5 (page 390). The lower half of the exhibit shows actual quantity and cost data for January 2001. This standard and actual cost information is used to compute the monthly variances.

4

How are material, labor, and overhead variances calculated and recorded?

Material Variances

The model introduced earlier is used to compute price and quantity variances for materials. A price and quantity variance can be computed for each type of material. To illustrate the calculations, direct material item L-04 is used.

$\text{AP} \times \text{AQ}$	$\text{SP} \times \text{AQ}$	$\text{SP} \times \text{SQ}$
$\$4.10 \times 813$	$\$4.00 \times 813$	$\$4.00 \times 800$
$\$3,333.30$	$\$3,252$	$\$3,200$
$\$81.30 \text{ U}$		$\$52 \text{ U}$
Material Price Variance		Material Quantity Variance
$\$133.30 \text{ U}$		
Total Material Variance		

where: AP is actual price paid for the input

AQ is the actual quantity purchased and consumed

SP is the standard price of the input

SQ is the standard quantity of the input

If the actual price or quantity amounts are larger than the standard price or quantity amounts, the variance is unfavorable (U); if the standards are larger than the actuals, the variance is favorable (F).

The **material price variance** (MPV) indicates whether the amount paid for material was below or above the standard price. For item L-04, the price paid

material price variance

EXHIBIT 10-5

Standard and Actual Cost Data
for Picnic Tables: January 2001

STANDARD COSTS FOR 400 PICNIC TABLES			
Direct Material			
Item	Quantity	Price	Total Cost
L-04	800	\$4.00	\$ 3,200
L-07	400	8.00	3,200
P-13	800	7.00	5,600
P-19	6,400	0.05	320
P-21	3,200	0.10	320
F-33	400	1.20	480
P-100	400	0.20	80
I-09	400	3.00	1,200
Total standard direct material cost			<u>\$14,400</u>
Direct Labor			
Department	Minutes	Rate	Total Cost
Cutting	4,000	\$0.40	\$ 1,600
Drilling	3,200	0.30	960
Sanding	7,200	0.35	2,520
Finishing	1,600	0.45	720
Packaging	2,000	0.25	500
Total standard direct labor cost			<u>\$ 6,300</u>
Overhead			
Variable (300 × \$24)*			\$ 7,200
Fixed (400 × \$15)			6,000
Total standard overhead cost			<u>\$13,200</u>
ACTUAL COSTS FOR 400 PICNIC TABLES			
Direct Material			
Item	Quantity	Price	Total Cost
L-04	813	\$4.10	\$ 3,333.30
L-07	400	7.75	3,100.00
P-13	810	7.05	5,710.50
P-19	6,700	0.06	402.00
P-21	3,300	0.12	396.00
F-33	411	1.30	534.30
P-100	425	0.18	76.50
I-09	413	2.80	1,156.40
Total actual direct material cost			<u>\$14,709.00</u>
Direct Labor			
Department	Minutes	Rate	Total Cost
Cutting	4,200	\$0.45	\$ 1,890.00
Drilling	3,300	0.32	1,056.00
Sanding	7,000	0.35	2,450.00
Finishing	1,800	0.46	828.00
Packaging	2,120	0.28	593.60
Totals	<u>18,420</u>		<u>\$ 6,817.60</u>
Overhead			
Variable			\$ 7,061
Fixed			7,400
Total actual overhead cost			<u>\$14,461</u>
*300 hours = (4,000 + 3,200 + 7,200 + 1,600 + 2,000) ÷ 60			

was \$4.10 per board, whereas the standard was \$4.00. The unfavorable MPV of \$81.30 can also be calculated as $[(\$4.10 - \$4.00)(813) = (\$0.10)(813) = \$81.30]$. The variance is unfavorable because the actual price paid is greater than the standard allowed.

The **material quantity variance** (MQV) indicates whether the actual quantity used was below or above the standard quantity allowed for the actual output. This difference is multiplied by the standard price per unit of material. Picnic table production used 13 more boards than the standard allowed, resulting in an unfavorable material quantity variance $[(813 - 800)(\$4.00) = (13)(\$4.00) = \$52]$. The variance sign is positive because actual quantity is greater than standard.

The total material variance (\$133.30 U) can be calculated by subtracting the total standard cost of input (\$3,200) from the total actual cost of input (\$3,333.30). The total variance also represents the summation of the individual variances: $(\$81.30 + \$52.00) = \$133.30$ (an unfavorable variance).

To find the total direct material cost variances, the computation of the price and quantity variances is repeated for each direct material item. The price and quantity variances are then summed across items to obtain the total price and quantity variances.

material quantity variance

Point of Purchase Material Variance Model

A total variance for a cost component is generally equal to the sum of the price and usage variances. An exception to this rule occurs when the quantity of material purchased is not the same as the quantity of material placed into production. Because the material price variance relates to the purchasing (not production) function, the point of purchase model calculates the material price variance using the quantity of materials purchased rather than the quantity of materials used. The general model can be altered slightly to isolate the variance as close to the source as possible and provide more rapid information for management control purposes.

As shown in Exhibit 10-5, Parkside Products used 813 boards to make 400 picnic tables in January 2001. However, rather than purchasing only 813 boards, assume the company purchased 850 at the price of \$4.10. Using this information, the material price variance is calculated as

$$\begin{array}{r}
 \text{AP} \times \text{AQ} \\
 \$4.10 \times 850 \\
 \$3,485 \\
 \hline
 \text{SP} \times \text{AQ} \\
 \$4.00 \times 850 \\
 \$3,400 \\
 \hline
 \text{\$85 U} \\
 \text{Material Price Variance}
 \end{array}$$

This change in the general model is shown below, using subscripts to indicate actual quantity purchased (p) and used (u).

$$\begin{array}{r}
 \text{AP} \times \text{AQ}_p \\
 \hline
 \text{Material Price Variance} \\
 \hline
 \text{SP} \times \text{AQ}_u \\
 \hline
 \text{Material Quantity Variance} \\
 \hline
 \text{SP} \times \text{SQ}_u
 \end{array}$$

The material quantity variance is still computed on the basis of the actual quantity used. Thus, the MQV remains at \$52 U. Because the price and quantity variances have been computed using different bases, they should not be summed and no total material variance can be meaningfully determined.

Labor Variances

The labor variances for picnic table production in January 2001 would be computed on a departmental basis and then summed across departments. To illustrate the computations, the Cutting Department data are applied as follows:

$AP \times AQ$	$SP \times AQ$	$SP \times SQ$
$\$0.45 \times 4,200$	$\$0.40 \times 4,200$	$\$0.40 \times 4,000$
\$1,890	\$1,680	\$1,600
\$210 U		\$80 U
Labor Rate Variance		Labor Efficiency Variance
\$290 U		
Total Labor Variance		

labor rate variance

The **labor rate variance** (LRV) shows the difference between the actual wages paid to labor for the period and the standard wages for all hours worked. The LRV can also be computed as $[(\$0.45 - \$0.40)(4,200) = (\$0.05)(4,200) = \$210 \text{ U}]$. Multiplying the standard labor rate by the difference between the actual minutes worked and the standard minutes for the production achieved results in the **labor efficiency variance** (LEV): $[(4,200 - 4,000)(\$0.40) = (200)(\$0.40) = \$80]$.

labor efficiency variance

OVERHEAD VARIANCES

In developing overhead application rates, a company must specify an operating level or capacity. Capacity refers to the level of activity. Alternative activity measures include theoretical, practical, normal, and expected capacity. Because total variable overhead changes in direct relationship with changes in activity and fixed overhead per unit changes inversely with changes in activity, a specific activity level must be chosen to determine budgeted overhead costs.

theoretical capacity

The estimated maximum potential activity for a specified time is the **theoretical capacity**. This measure assumes that all factors are operating in a technically and humanly perfect manner. Theoretical capacity disregards realities such as machinery breakdowns and reduced or stopped plant operations on holidays. Reducing theoretical capacity by ongoing, regular operating interruptions (such as holidays, downtime, and start-up time) provides the **practical capacity** that could be achieved during regular working hours. Consideration of historical and estimated future production levels and the cyclical fluctuations provides a **normal capacity** measure that encompasses the long-run (5 to 10 years) average activity of the firm. This measure represents a reasonably attainable level of activity, but will not provide costs that are most similar to actual historical costs. Thus, many firms use expected capacity as the selected measure of activity. Expected capacity is a short-run concept that represents the anticipated level of the firm for the upcoming annual period. If actual results are close to budgeted results (in both dollars and volume), this measure should result in product costs that most closely reflect actual costs. The News Note on page 393 discusses the challenges inherent in selecting a capacity measure.

practical capacity

normal capacity

<http://www.howmet.com/home.nsf/facilitypages/whitehall+casting>

flexible budget

A **flexible budget** is a planning document that presents expected overhead costs at different activity levels. In a flexible budget, all costs are treated as either variable or fixed; thus, mixed costs must be separated into their variable and fixed elements.

The activity levels shown on a flexible budget usually cover the contemplated range of activity for the upcoming period. If all activity levels are within the relevant

GENERAL BUSINESS



NEWS NOTE

The Fixed Cost Challenge

Bring up the topic of standard costing and you're almost certain to touch off a lively debate. Cost accountants have varying opinions on how to set standards and how to interpret them.

Tim McDonald, information systems manager and assistant controller at Howmet's Whitehall (MI) casting facility, finds the biggest challenge he faces with standard costing is handling fixed and semi-fixed costs. Volume changes will result in different fixed costs per unit because, by definition, these costs do not change (in total) with different volumes (at least within a certain range of production). There's a danger management will mistakenly think its fixed costs have decreased due to higher volumes and underprice its parts, even when future volumes are lower.

To determine volume for standard fixed cost allocation, Whitehall's cost managers look at the various operations or capital equipment required, and use 80% of total capacity (to allow for normal downtime for maintenance and as a buffer for unforeseen breakdowns). Accounting textbooks might refer to this as "practical capacity." Using practical capacity in developing fixed cost allocation rates results in cost standards that include only the cost of capacity actually used in production. Whitehall partially tracks the cost of unused capacity through efficiency percentages.

SOURCE: Kip R. Krumwiede, "Tips from the Trenches on Standard Costing," *Cost Management Update* (April 2000), pp. 1-3.

range, costs at each successive level should equal the previous level plus a uniform monetary increment for each variable cost factor. The increment is equal to variable cost per unit of activity times the quantity of additional activity.

The predetermined variable and fixed overhead rates shown in Exhibit 10-4 were calculated for picnic table production using expected capacity of 6,000 units and 4,500 labor hours (3/4 hour each \times 6,000). At this level of activity, expected annual variable overhead for picnic table production is \$108,000 ($\$24 \times 4,500$) and expected fixed overhead is \$90,000 ($\$15 \times 6,000$). Exhibit 10-6 provides a flexible budget for picnic table production at three alternative activity levels: 5,000, 6,000, and 7,000 units. The flexible budget indicates that the unit cost for overhead declines as volume increases. This results because the per-unit cost of fixed overhead moves inversely with volume changes. Managers of Parkside Products selected 6,000 units of production as a basis for determining rates of overhead application.

The use of separate variable and fixed overhead application rates and accounts allows separate price and usage variances to be computed for each type of overhead. Such a four-variance approach provides managers with the greatest detail and, thus, the greatest flexibility for control and performance evaluation.

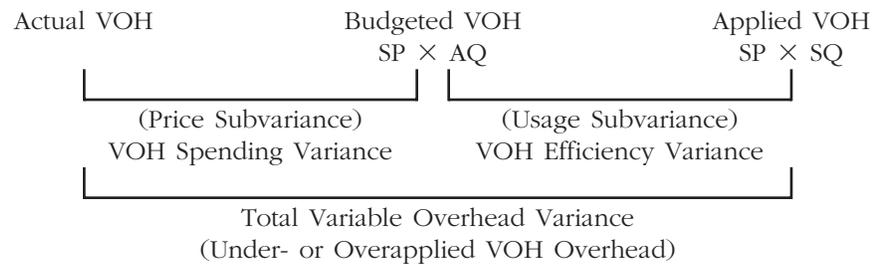
Units of Production	5,000	6,000	7,000
Labor hours	3,750	4,500	5,250
\times hourly overhead rate	\times \$24	\times \$24	\times \$24
Total variable overhead	\$ 90,000	\$108,000	\$126,000
Fixed overhead	90,000	90,000	90,000
Total overhead	<u>\$180,000</u>	<u>\$198,000</u>	<u>\$216,000</u>
Total overhead cost per unit	<u>\$36.00</u>	<u>\$33.00</u>	<u>\$30.86</u>

EXHIBIT 10-6

Flexible Overhead Budget for Picnic Table Production

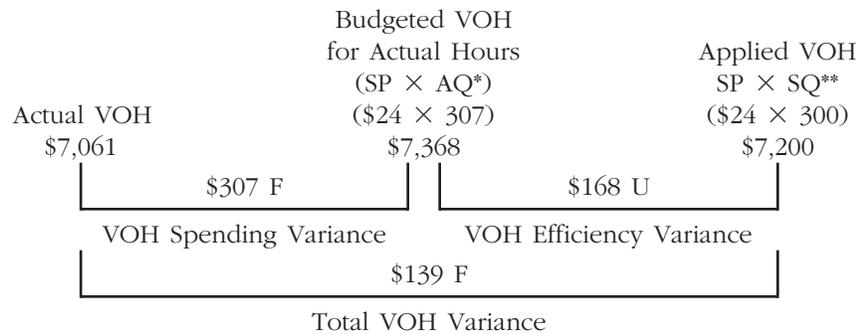
Variable Overhead

The general variance analysis model can be used to calculate the price and usage subvariances for variable overhead (VOH) as follows:



Actual VOH cost is debited to the Variable Manufacturing Overhead account; applied VOH reflects the standard overhead application rate multiplied by the standard quantity of activity for the actual output of the period. Applied VOH is debited to Work in Process Inventory and credited to Variable Manufacturing Overhead. The total VOH variance is the balance in the variable overhead account at year-end and equals the amount of underapplied or overapplied VOH.

Using the information in Exhibit 10–5, the variable overhead variances for picnic table production are calculated as follows:



*Actual hours = $18,420 \div 60 = 307$

**Standard hours = $400 \times (45/60) = 300$

variable overhead spending variance

The difference between actual VOH and budgeted VOH based on actual hours is the **variable overhead spending variance**. Variable overhead spending variances are often caused by price differences—paying higher or lower prices than the standard prices allowed. Such fluctuations may occur because, over time, changes in variable overhead prices have not been reflected in the standard rate. For example, average indirect labor wage rates or utility rates may have changed since the predetermined variable overhead rate was computed. Managers usually have little control over prices charged by external parties and should not be held accountable for variances arising because of such price changes. In these instances, the standard rates should be adjusted.

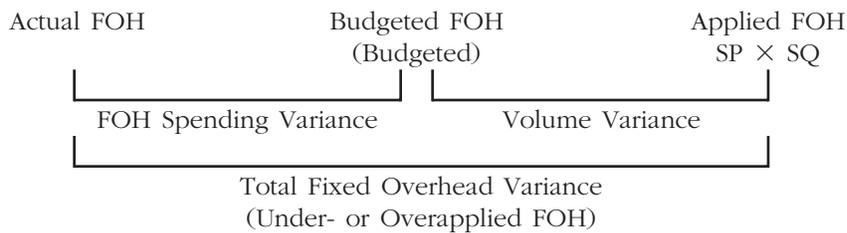
Another possible cause of the VOH spending variance is waste or shrinkage associated with production resources (such as indirect materials). For example, deterioration of materials during storage or from lack of proper handling may be recognized only after those materials are placed into production. Such occurrences usually have little relationship to the input activity basis used, but they do affect the VOH spending variance. If waste or spoilage is the cause of the VOH spending variance, managers should be held accountable and encouraged to implement more effective controls.

The difference between budgeted VOH for actual hours and standard VOH is the **variable overhead efficiency variance**. This variance quantifies the effect of using more or less actual input than the standard allowed for the production achieved. When actual input exceeds standard input allowed, production operations are considered to be inefficient. Excess input also indicates that a larger VOH budget is needed to support the additional input.

**variable overhead
efficiency variance**

Fixed Overhead

The total fixed overhead (FOH) variance is divided into its price and usage sub-variances by inserting budgeted fixed overhead as a middle column into the general model as follows:



In the model, the left column is simply labeled “actual cost” and is not computed as a price times quantity measure because FOH is incurred in lump sums. Actual FOH cost is debited to Fixed Manufacturing Overhead. Budgeted FOH is a constant amount throughout the relevant range; thus, the middle column is a constant figure regardless of the actual quantity of input or the standard quantity of input allowed. This concept is a key element in computing FOH variances. The budgeted amount of fixed overhead can also be presented analytically as the result of multiplying the standard FOH application rate by the capacity measure that was used to compute that standard rate (5,000 units for Parkside Products’ picnic tables).

The difference between actual and budgeted FOH is the **fixed overhead spending variance**. This amount normally represents a weighted average price variance of the multiple components of FOH, although it can also reflect mismanagement of resources. The individual FOH components are detailed in the flexible budget, and individual spending variances should be calculated for each component.

**fixed overhead spending
variance**

As with variable overhead, applied FOH is related to the standard application rate and the standard hours allowed for the actual production level. In regard to fixed overhead, the standard input allowed for the achieved production level measures capacity utilization for the period. Applied fixed overhead is debited to Work in Process Inventory and credited to Fixed Manufacturing Overhead.

The fixed overhead **volume variance** is the difference between budgeted and applied fixed overhead. The volume variance is caused solely by producing at a level that differs from that used to compute the predetermined overhead rate. The volume variance occurs because, by using an application rate per unit of activity, FOH cost is treated as if it were variable even though it is not.

volume variance

Although capacity utilization is controllable to some degree, the volume variance is the variable over which managers have the least influence and control, especially in the short run. So volume variance is also called **noncontrollable variance**. This lack of influence is usually not too important. What is important is whether managers exercise their ability to adjust and control capacity utilization properly. The degree of capacity utilization should always be viewed in relationship to inventory and sales. Managers must understand that underutilization of capacity is not always an undesirable condition. It is significantly more appropriate

noncontrollable variance

for managers to regulate production than to produce goods that will end up in inventory stockpiles. Unneeded inventory production, although it serves to utilize capacity, generates substantially more costs for materials, labor, and overhead (including storage and handling costs). The positive impact that such unneeded production will have on the volume variance is insignificant because this variance is of little or no value for managerial control purposes.

The difference between actual FOH and applied FOH is the total fixed overhead variance and is equal to the amount of underapplied or overapplied fixed overhead.

Inserting the data from Exhibit 10–5 for picnic table production into the model gives the following:

	Monthly Budgeted FOH ($\$90,000 \div 12$ months)	Applied FOH ($\$15 \times 400$ units)
Actual FOH \$7,400	\$7,500	\$6,000
\$100 F FOH Spending Variance		\$1,500 U Volume Variance
\$1,400 U Total FOH Variance		

The reason the FOH application rate is \$15 per unit is that a capacity level of 6,000 units for the year was chosen. Had any other capacity level been chosen, the rate would have differed, even though the total amount of budgeted monthly fixed overhead (\$7,500) would have remained the same. If any level of capacity other than that used in determining the application rate is used to apply FOH, a volume variance will occur. For example, if the department had chosen 4,800 units as the denominator level of activity to set the predetermined FOH rate, there would be no volume variance for January 2001—expected volume would be equal to actual production volume.

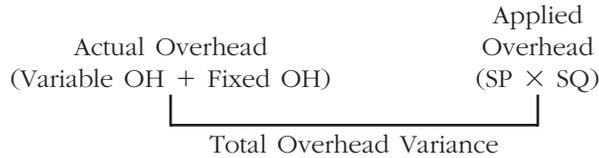
Management is usually aware, as production occurs, of the physical level of capacity utilization even if a volume variance is not reported. The volume variance, however, translates the physical measurement of underutilization or overutilization into a dollar amount. An unfavorable volume variance indicates less-than-expected utilization of capacity. If available capacity is currently being utilized at a level below (or above) that which was anticipated, managers are expected to recognize that condition, investigate the reasons for it, and (if possible and desirable) initiate appropriate action. Managers can sometimes influence capacity utilization by modifying work schedules, taking measures to relieve any obstructions to or congestion of production activities, and carefully monitoring the movement of resources through the production process. Preferably, such actions should be taken before production rather than after it. Efforts made after production is completed may improve next period's operations, but will have no impact on past production.

Alternative Overhead Variance Approaches

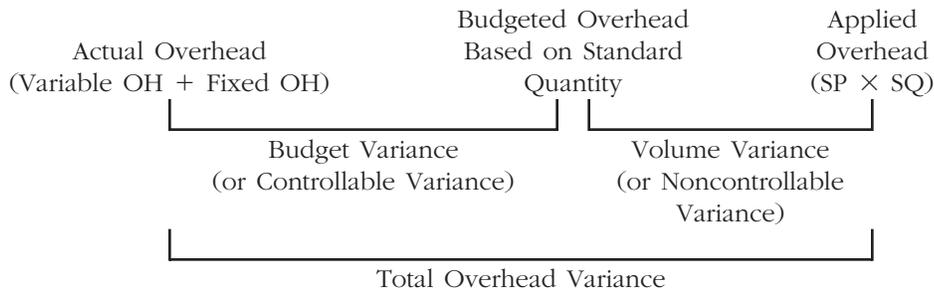
If the accounting system does not distinguish between variable and fixed costs, a four-variance approach is unworkable. Use of a combined (variable and fixed) overhead rate requires alternative overhead variance computations. A one-variance approach calculates only a **total overhead variance** as the difference between total actual overhead and total overhead applied to production. The amount of applied overhead is determined by multiplying the combined rate by the standard

total overhead variance

input activity allowed for the actual production achieved. The one-variance model is diagrammed as follows:



Like other total variances, the total overhead variance provides limited information to managers. Two-variance analysis is performed by inserting a middle column in the one-variance model as follows:



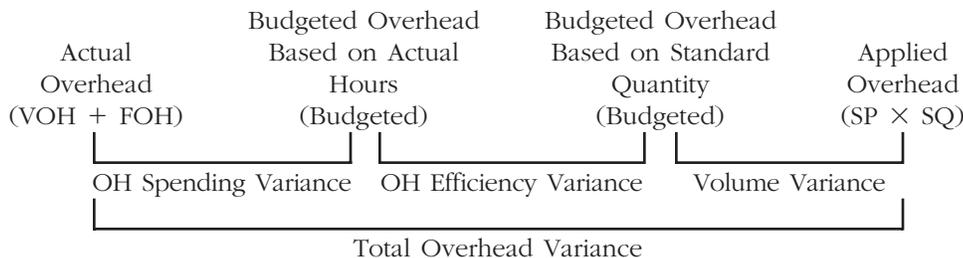
The middle column provides information on the expected total overhead cost based on the standard quantity. This amount represents total budgeted variable overhead at standard hours plus budgeted fixed overhead, which is constant across all activity levels in the relevant range.

The **budget variance** equals total actual overhead minus budgeted overhead based on the standard quantity for this period's production. This variance is also referred to as the **controllable variance** because managers are somewhat able to control and influence this amount during the short run. The difference between total applied overhead and budgeted overhead based on the standard quantity is the volume variance.

budget variance

controllable variance

A modification of the two-variance approach provides a three-variance analysis. Inserting another column between the left and middle columns of the two-variance model separates the budget variance into spending and efficiency variances. The new column represents the flexible budget based on the actual hours. The three-variance model is as follows:



The spending variance shown in the three-variance approach is a total **overhead spending variance**. It is equal to total actual overhead minus total budgeted overhead at the actual activity level. The **overhead efficiency variance** is related solely to variable overhead and is the difference between total budgeted overhead at the actual activity level and total budgeted overhead at the standard activity level. This variance measures, at standard cost, the approximate amount of

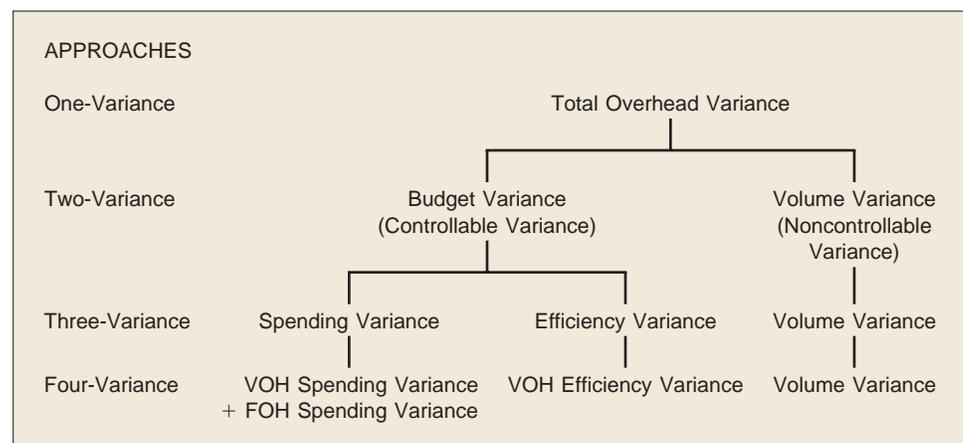
overhead spending variance
overhead efficiency variance

variable overhead caused by using more or fewer inputs than is standard for the actual production. The sum of the overhead spending and overhead efficiency variances of the three-variance analysis is equal to the budget variance of the two-variance analysis. The volume variance amount is the same as that calculated using the two-variance or the four-variance approach.

If variable and fixed overhead are applied using the same base, the one-, two-, and three-variance approaches will have the interrelationships shown in Exhibit 10-7. (The demonstration problem at the end of the chapter shows computations for each of the overhead variance approaches.) Managers should select the method that provides the most useful information and that conforms to the company's accounting system. As more companies begin to recognize the existence of multiple cost drivers for overhead and to use multiple bases for applying overhead to production, computation of the one-, two-, and three-variance approaches will diminish.

EXHIBIT 10-7

Interrelationships of Overhead Variances



STANDARD COST SYSTEM JOURNAL ENTRIES

Journal entries using Parkside Products' picnic table production data for January 2001 are given in Exhibit 10-8. The following explanations apply to the numbered journal entries.

1. The debit to Raw Material Inventory is for the standard price of the actual quantity of materials purchased. The credit to Accounts Payable is for the actual price of the actual quantity of materials purchased. The debit to the variance account reflects the unfavorable material price variance. It is assumed that all materials purchased were used in production during the month.
2. The debit to Work in Process Inventory is for the standard price of the standard quantity of material, whereas the credit to Raw Material Inventory is for the standard price of the actual quantity of material used in production. The credit to the Material Quantity Variance account reflects the overuse of materials valued at the standard price.
3. The debit to Work in Process Inventory is for the standard hours allowed to produce 400 picnic tables multiplied by the standard wage rate. The Wages Payable credit is for the actual amount of direct labor wages paid during the period. The debit to the Labor Rate Variance account reflects the unfavorable rate differential. The Labor Efficiency Variance debit reflects the greater-than-standard hours allowed multiplied by the standard wage rate.

EXHIBIT 10-8

Journal Entries for Picnic Table
Production: January 2001

(1)	Raw Material Inventory	14,604.20	
	Material Purchase Price Variance ¹	104.80	
	Accounts Payable		14,709.00
	To record the acquisition of material.		
(2)	Work in Process Inventory	14,400.00	
	Material Quantity Variance ²	204.20	
	Raw Material Inventory		14,604.20
	To record actual material issuances.		
(3)	Work in Process Inventory	6,300.00	
	Labor Rate Variance ³	160.00	
	Labor Efficiency Variance ⁴	357.60	
	Wages Payable		6,817.60
	To record incurrence of direct labor costs in all departments.		
(4)	Variable Manufacturing Overhead	7,061.00	
	Fixed Manufacturing Overhead	7,400.00	
	Various accounts		14,461.00
	To record the incurrence of actual overhead costs.		
(5)	Work in Process Inventory	13,200.00	
	Variable Manufacturing Overhead		7,200.00
	Fixed Manufacturing Overhead		6,000.00
	To apply standard overhead cost to production.		
(6)	Variable Overhead Efficiency Variance	168.00	
	Variable Manufacturing Overhead	139.00	
	Variable Overhead Spending Variance		307.00
	To close the variable overhead account.		
(7)	Volume Variance	1,500.00	
	Fixed Manufacturing Overhead		1,400.00
	Fixed Overhead Spending Variance		100.00
	To close the fixed overhead account.		

¹The price material variance by item is as follows:

L-04	\$ 81.30 U
L-07	100.00 F
P-13	40.50 U
P-19	67.00 U
P-21	66.00 U
F-33	41.10 U
P-100	8.50 F
I-09	82.60 F
Total	<u>\$104.80 U</u>

²The quantity material variance by item is as follows:

L-04	\$ 52.00 U
L-07	0.00
P-13	70.00 U
P-19	15.00 U
P-21	10.00 U
F-33	13.20 U
P-100	5.00 U
I-09	39.00 U
Total	<u>\$204.20 U</u>

³The labor rate variance by department is as follows:

Cutting	\$210.00 U
Drilling	66.00 U
Sanding	0.00
Finishing	18.00 U
Packaging	63.60 U
Total	<u>\$357.60 U</u>

⁴The labor rate variance by department is as follows:

Cutting	\$ 80.00 U
Drilling	30.00 U
Sanding	70.00 F
Finishing	90.00 U
Packaging	30.00 U
Total	<u>\$160.00 U</u>

- During the period, actual costs incurred for the various variable and fixed overhead components are debited to the manufacturing overhead accounts. These costs are caused by a variety of transactions including indirect material and labor usage, depreciation, and utility costs.
- Overhead is applied to production using the predetermined rates multiplied by the standard input allowed. Overhead application is recorded at completion of production or at the end of the period, whichever is earlier. The difference

between actual debits and applied credits in each overhead account represents the total variable and fixed overhead variances and is also the underapplied or overapplied overhead for the period.

6. & 7. These entries assume an end-of-month closing of the Variable Manufacturing Overhead and Fixed Manufacturing Overhead accounts. The balances in the accounts are reclassified to the appropriate variance accounts. This entry is provided for illustration only. This process would typically not be performed at month-end, but rather at year-end, because an annual period is used to calculate the overhead application rates.

Note that all unfavorable variances have debit balances and favorable variances have credit balances. Unfavorable variances represent excess production costs; favorable variances represent savings in production costs. Standard production costs are shown in inventory accounts (which have debit balances); therefore, excess costs are also debits.

Although standard costs are useful for internal reporting, they can only be used in financial statements when they produce figures substantially equivalent to those that would have resulted from using an actual cost system. If standards are realistically achievable and current, this equivalency should exist. Standard costs in financial statements should provide fairly conservative inventory valuations because effects of excess prices and/or inefficient operations are eliminated.

At year-end, adjusting entries must be made to eliminate standard cost variances. The entries depend on whether the variances are, in total, insignificant or significant. If the combined impact of the variances is immaterial, unfavorable variances are closed as debits to Cost of Goods Sold; favorable variances are credited to Cost of Goods Sold. Thus, unfavorable variances have a negative impact on operating income because of the higher-than-expected costs, whereas favorable variances have a positive effect on operating income because of the lower-than-expected costs. Although the year's entire production may not have been sold yet, this variance treatment is based on the immateriality of the amounts involved.

In contrast, large variances are prorated at year-end among ending inventories and Cost of Goods Sold. This proration disposes of the variances and presents the financial statements in a manner that approximates the use of actual costing. Proration is based on the relative size of the account balances. Disposition of significant variances is similar to the disposition of large amounts of underapplied or overapplied overhead shown in Chapter 3.

To illustrate the disposition of significant variances, assume that there is a \$2,000 unfavorable (debit) year-end balance in the Material Purchase Price Variance account of Parkside Products. Other relevant year-end account balances are as follows:

Raw Material Inventory	\$ 49,126
Work in Process Inventory	28,072
Finished Goods Inventory	70,180
Cost of Goods Sold	<u>554,422</u>
Total of affected accounts	<u>\$701,800</u>

The theoretically correct allocation of the material purchase price variance would use actual material cost in each account at year-end. However, as was mentioned in Chapter 3 with regard to overhead, after the conversion process has begun, cost elements within account balances are commingled and tend to lose their identity. Thus, unless a significant misstatement would result, disposition of the variance can be based on the proportions of each account balance to the total, as shown below:

Raw Material Inventory	7%	(\$ 49,126 ÷ \$701,800)
Work in Process Inventory	4%	(\$ 28,072 ÷ \$701,800)
Finished Goods Inventory	10%	(\$ 70,180 ÷ \$701,800)
Cost of Goods Sold	79%	(\$554,422 ÷ \$701,800)

Applying these percentages to the \$2,000 material price variance gives the amounts shown in the following journal entry to assign to the affected accounts:

Raw Material Inventory ($\$2,000 \times 0.07$)	140	
Work in Process Inventory ($\$2,000 \times 0.04$)	80	
Finished Goods Inventory ($\$2,000 \times 0.10$)	200	
Cost of Goods Sold ($\$2,000 \times 0.79$)	1,580	
Material Purchase Price Variance		2,000
To dispose of the material price variance at year-end.		

All variances other than the material price variance occur as part of the conversion process. Raw material purchases are not part of conversion, but raw material used is. Therefore, the remaining variances are prorated only to Work in Process Inventory, Finished Goods Inventory, and Cost of Goods Sold. The preceding discussion about standard setting, variance computations, and year-end adjustments indicates that a substantial commitment of time and effort is required to implement and use a standard cost system. Companies are willing to make such a commitment for a variety of reasons.

WHY STANDARD COST SYSTEMS ARE USED

“A standard cost system has three basic functions: collecting the actual costs of a manufacturing operation, determining the achievement of that manufacturing operation, and evaluating performance through the reporting of variances from standard.”⁷ These basic functions result in six distinct benefits of standard cost systems.

5

What are the benefits organizations derive from standard costing and variance analysis?

Clerical Efficiency

A company using standard costs usually discovers that less clerical time and effort are required than in an actual cost system. In an actual cost system, the accountant must continuously recalculate changing actual unit costs. In a standard cost system, unit costs are held constant for some period. Costs can be assigned to inventory and cost of goods sold accounts at predetermined amounts per unit regardless of actual conditions.

Motivation

Standards are a way to communicate management's expectations to workers. When standards are achievable and when workers are informed of rewards for standards attainment, those workers are likely to be motivated to strive for accomplishment. The standards used must require a reasonable amount of effort on the workers' part.

Planning

Planning generally requires estimates about the future. Managers can use current standards to estimate future quantities and costs. These estimates should help in the determination of purchasing needs for material, staffing needs for labor, and capacity needs related to overhead that, in turn, will aid in planning for company cash flows. In addition, budget preparation is simplified because a standard is, in fact, a budget for one unit of product or service. Standards are also used to provide the cost basis needed to analyze relationships among costs, sales volume, and profit levels of the organization.

⁷ Richard V. Calvasina and Eugene J. Calvasina, “Standard Costing Games That Managers Play,” *Management Accounting* (March 1984), p. 49. Although the authors of the article only specified manufacturing operations, these same functions are equally applicable to service businesses.

Controlling

variance analysis

The control process begins with the establishment of standards that provide a basis against which actual costs can be measured and variances calculated. **Variance analysis** is the process of categorizing the nature (favorable or unfavorable) of the differences between actual and standard costs and seeking explanations for those differences. A well-designed variance analysis system captures variances as early as possible, subject to cost-benefit assessments. The system should help managers determine who or what is responsible for each variance and who is best able to explain it. An early measurement and reporting system allows managers to monitor operations, take corrective action if necessary, evaluate performance, and motivate workers to achieve standard production.

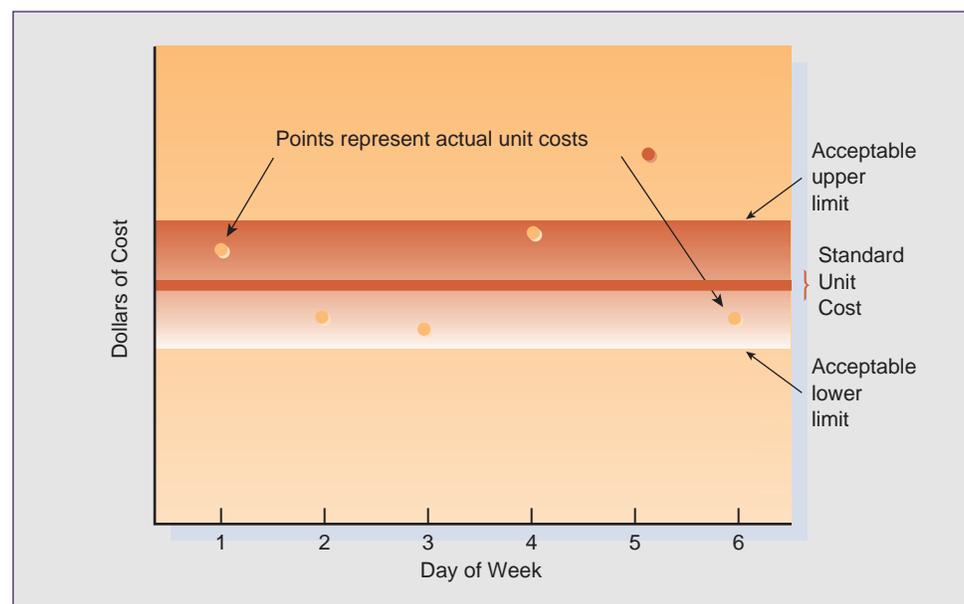
In implementing control, managers must recognize that they are faced with a specific scarce resource: their time. They must distinguish between situations that can be ignored and those that need attention. To make this distinction, managers establish upper and lower limits of acceptable deviations from standard. These limits are similar to tolerance limits used by engineers in the development of statistical process control charts. If variances are small and within an acceptable range, no managerial action is required. If an actual cost differs significantly from standard, the manager responsible for the cost is expected to determine the variance cause(s). If the cause(s) can be found and corrective action is possible, such action should be taken so that future operations will adhere more closely to established standards.

The setting of upper and lower tolerance limits for deviations allows managers to implement the management by exception concept, as illustrated in Exhibit 10-9. In the exhibit, the only significant deviation from standard occurred on Day 5, when the actual cost exceeded the upper limit of acceptable performance. An exception report should be generated on this date so that the manager can investigate the underlying variance causes.

Variances large enough to fall outside the acceptability ranges often indicate problems. However, a variance does not reveal the cause of the problem nor the person or group responsible. To determine variance causality, managers must investigate significant variances through observation, inspection, and inquiry. The

EXHIBIT 10-9

Illustration of Management by Exception Concept



investigation will involve people at the operating level as well as accounting personnel. Operations personnel should be alert in spotting variances as they occur and record the reasons for the variances to the extent they are discernable. For example, operating personnel could readily detect and report causes such as machine downtime or material spoilage.

One important point about variances: An extremely favorable variance is not necessarily a good variance. Although people often want to equate the “favorable” designation with good, an extremely favorable variance could mean an error was made when the standard was set or that a related, offsetting unfavorable variance exists. For example, if low-grade material is purchased, a favorable price variance may exist, but additional quantities of the material might need to be used to overcome defective production. An unfavorable labor efficiency variance could also result because more time was required to complete a job as a result of using the inferior materials. Not only are the unfavorable variances incurred, but internal quality failure costs are also generated. Another common situation begins with labor rather than material. Using lower paid workers will result in a favorable rate variance, but may cause excessive use of raw materials. Managers must constantly be aware that relationships exist and, hence, that variances cannot be analyzed in isolation.

The time frame for which variance computations are made is being shortened. Monthly variance reporting is still common, but the movement toward shorter reporting periods is obvious. As more companies integrate various world-class concepts such as total quality management and just-in-time production into their operations, reporting of variances will become more frequent. Proper implementation of such concepts requires that managers be continuously aware of operating activities and recognize (and correct) problems as soon as they arise. As discussed in the accompanying News Note, control of product costs must begin well before the life-cycle stage where standard costing is appropriate. Most costs are committed by the time a product enters the manufacturing stage.

GENERAL BUSINESS



NEWS NOTE

Controlling Costs by Design

Between 75% and 90% of a product's costs are predetermined when the product design is finished, according to experts. It follows that if such a large proportion of costs are immutable once design is complete, then to manage costs effectively management accountants must participate during the design of products, providing useful cost data and financial expertise.

At first glance, management accountants may recoil from this notion, fearing that they have little to contribute to the design or engineering of a product, but recent trends make it feasible for management accountants to be involved in product development without requiring that they be experts in product aesthetics or product engineering. At many firms, product design has evolved from a sequential process where the new product was thrown “over the wall” from one department to another. This process often involves a team effort with team members drawn from marketing, industrial design, product engi-

neering, and manufacturing. The product design team integrates views of all key constituencies to make the trade-offs necessary to ensure that the design meets the needs of all: Is it designed for manufacturability? Does it possess the features that will provide customers valuable benefits? Is it engineered to provide consistent quality?

The cross-functional product team provides the ideal opportunity for the management accountant to participate to ensure control of product costs. Through interactions among the management accountant and members of other functions, the team can ensure that the appropriate balance is maintained between cost and other important product characteristics such as quality, function, appearance, and manufacturability.

SOURCE: Julie H. Hertenstein and Marjorie B. Platt, “Why Product Development Teams Need Management Accountants,” *Management Accounting* (April 1998), pp. 50–55.

Decision Making

Standard cost information facilitates decision making. For example, managers can compare a standard cost with a quoted price to determine whether an item should be manufactured in-house or instead be purchased. Use of actual cost information in such a decision could be inappropriate because the actual cost may fluctuate from period to period. Also, in making a decision on a special price offering to purchasers, managers can use standard product cost to determine the lower limit of the price to offer. In a similar manner, if a company is bidding on contracts, it must have some idea of estimated product costs. Bidding too low and receiving the contract could cause substantial operating income (and, possibly, cash flow) problems; bidding too high might be uncompetitive and cause the contract to be awarded to another company.

The accompanying News Note discusses an alternative standard costing systems that can improve information used for decision making.

Performance Evaluation

When top management receives summary variance reports highlighting the operating performance of subordinate managers, these reports are analyzed for both positive and negative information. Top management needs to know when costs

NEWS NOTE



GENERAL BUSINESS

Which Standard Costing System?

Anyone preparing to install or overhaul a costing system needs to think along three main dimensions: according to whether the cost is established before or after the event, i.e., standard or actual, respectively; according to whether indirect costs are included or not, i.e., absorption costing or variable costing, respectively; and according to the cost units which are the focal point, e.g., product, process, or customer.

On this basis, one can contrast product costing with process costing, standard costing with actual costing, or absorption costing with variable costing, but it is completely illogical to contrast standard costing with any form of absorption costing. The fact is that various combinations are feasible, e.g., standard variable product costs or actual absorption process costs.

Faced with the task of making decisions, those who are members of management teams are unlikely to be interested in the average costs produced by absorption systems. Rather, we are more likely to be interested in incremental costs, e.g., what do we think will be the increase in costs in response to an increase in volume arising from an investment in advertising? Do we think it would be cheaper to produce a given item in factory A or factory B, or to outsource it? What are we losing by shunning the next best alternative?

Only variable costing can embrace these concepts. Absorption costs are needed for various backward looking tasks, like computing the inventory figure for balance sheet purposes, but it is difficult to make a case for them in the context of any forward looking work, such as decision support.

Moreover, decision making being a totally forward-looking process, the management accounting system to support it is almost certain to call for costs to be established before the event, i.e., standard costing. Standard costing does not purport to calculate true costs since, assuming there are such things, they can only be identified after the event, by which time they are too late to be input to decisions.

Putting these two strands of thought together, it should not come as a surprise to find that the overwhelmingly popular choice, as regards management accounting systems in support of the making and monitoring of decisions, is standard variable costing.

SOURCE: David Allen, "Alive and Well," *Management Accounting (London)* (September 1999), p. 50.

were and were not controlled and by which managers. Such information allows top management to provide essential feedback to subordinates, investigate areas of concern, and make performance evaluations about who needs additional supervision, who should be replaced, and who should be promoted. For proper performance evaluations to be made, the responsibility for variances must be traced to specific managers.⁸

CONSIDERATIONS IN ESTABLISHING STANDARDS

When standards are established, appropriateness and attainability should be considered. Appropriateness, in relation to a standard, refers to the basis on which the standards are developed and how long they will be expected to last. Attainability refers to management's belief about the degree of difficulty or rigor that should be incurred in achieving the standard.

Appropriateness

Although standards are developed from past and current information, they should reflect relevant technical and environmental factors expected during the time in which the standards are to be applied. Consideration should be given to factors such as material quality, normal material ordering quantities, expected employee wage rates, degree of plant automation, facility layout, and mix of employee skills. Management should not think that, once standards are set, they will remain useful forever. Current operating performance is not comparable to out-of-date standards. Standards must evolve over the organization's life to reflect its changing methods and processes. Out-of-date standards produce variances that do not provide logical bases for planning, controlling, decision making, or evaluating performance.

Attainability

Standards provide a target level of performance and can be set at various levels of rigor. The level of rigor affects motivation, and one reason for using standards is to motivate employees. Standards can be classified as expected, practical, and ideal. Depending on the type of standard in effect, the acceptable ranges used to apply the management by exception principle will differ. This difference is especially notable on the unfavorable side.

Expected standards are set at a level that reflects what is actually expected to occur. Such standards anticipate future waste and inefficiencies and allow for them. As such, expected standards are not of significant value for motivation, control, or performance evaluation. If a company uses expected standards, the ranges of acceptable variances should be extremely small (and, commonly, favorable) because the actual costs should conform closely to standards.

expected standard

Standards that can be reached or slightly exceeded approximately 60 to 70 percent of the time with reasonable effort are called **practical standards**. These standards allow for normal, unavoidable time problems or delays such as machine downtime and worker breaks. Practical standards represent an attainable challenge and traditionally have been thought to be the most effective at inducing the best worker performance and at determining the effectiveness and efficiency of workers at performing their tasks. Both favorable and unfavorable variances result from the use of such moderately rigorous standards.

practical standard

⁸ Cost control relative to variances is discussed in greater depth in Chapter 15. Performance evaluation is discussed in greater depth in Chapters 19, 20 and 21.

ideal standard

Standards that provide for no inefficiency of any type are called **ideal standards**. Ideal standards encompass the highest level of rigor and do not allow for normal operating delays or human limitations such as fatigue, boredom, or misunderstanding. Unless a plant is entirely automated (and then the possibility of human or power failure still exists), ideal standards are impossible to attain. Attempts to apply such standards have traditionally resulted in discouraged and resentful workers who, ultimately, ignored the standards. Variances from ideal standards will always be unfavorable and were commonly not considered useful for constructive cost control or performance evaluation. Such a perspective has, however, begun to change.

CHANGES IN STANDARDS USAGE

In using variances for control and performance evaluation, many accountants (and, often, businesspeople in general) believe that an incorrect measurement is being used. For example, material standards generally include a factor for waste, and labor standards are commonly set at the expected level of attainment even though this level compensates for downtime and human error. Usage of standards that are not aimed at the highest possible (ideal) level of attainment are now being questioned in a business environment concerned with world-class operations.

Use of Ideal Standards and Theoretical Capacity

Japanese influence on Western management philosophy and production techniques has been significant. Just-in-time (JIT) production systems and total quality management (TQM) both evolved as a result of an upsurge in Japanese productivity. These two concepts are inherently based on a notable exception to the traditional disbelief in the use of ideals in standards development and use. Rather than including waste and inefficiency in the standards and then accepting additional waste and spoilage deviations under a management by exception principle, JIT and TQM both begin from the premises of zero defects, zero inefficiency, and zero downtime. Under JIT and TQM, ideal standards become expected standards and there is no (or only a minimal allowable) level of acceptable deviation from standards.

When the standard permits a deviation from the ideal, managers are allowing for inefficient uses of resources. Setting standards at the tightest possible level results in the most useful information for managerial purposes as well as the highest quality products and services at the lowest possible cost. If no inefficiencies are built into or tolerated in the system, deviations from standard should be minimized and overall organizational performance improved. Workers may, at first, resent the introduction of standards set at a “perfection” level, but it is in their and management’s best long-run interest to have such standards.

If theoretical standards are to be implemented, management must be prepared to go through a four-step “migration” process. First, teams should be established to determine current problems and the causes of those problems. Second, if the causes relate to equipment, the facility, or workers, management must be ready to invest in plant and equipment items, equipment rearrangements, or worker training so that the standards are amenable to the operations. (Training is essential if workers are to perform at the high levels of efficiency demanded by theoretical standards.) If problems are related to external sources (such as poor-quality materials), management must be willing to change suppliers and/or pay higher prices for higher grade input. Third, because the responsibility for quality has been assigned to workers, management must also empower those workers with the authority to react to problems. “The key to quality initiatives is for employees to move beyond their natural resistance-to-change mode to a highly focused, strategic, and empowered mind-set. This shift unlocks employees’ energy and creativity, and leads them to ask ‘How

can I do my job even better today?”⁹ Fourth, requiring people to work at their maximum potential demands recognition and means that management must provide rewards for achievement.

A company that wants to be viewed as a world-class competitor may want to use theoretical capacity in setting fixed overhead rates. If a company were totally automated or if people consistently worked to their fullest potential, such a measure would provide a reasonable overhead application rate. Thus, any underapplied overhead resulting from a difference between theoretical and actual capacity would indicate capacity that should be either used or eliminated; it could also indicate human capabilities that have not been fully developed. If a company uses theoretical capacity as the defined capacity measure, any end-of-period underapplied overhead should be viewed as a period cost and closed to a loss account (such as “Loss from Inefficient Operations”) on the income statement. Showing the capacity potential and the use of the differential in this manner should attract managerial attention to the inefficient and ineffective use of resources.

Whether setting standards at the ideal level and using theoretical capacity to determine FOH applications will become norms of non-Japanese companies cannot be determined at this time. However, we expect that attainability levels will move away from the expected or practical and closer to the ideal. This conclusion is based on the fact that a company whose competitor produces goods based on the highest possible standards must also use such standards to compete on quality and to meet cost (and, thus, profit margin) objectives. Higher standards for efficiency automatically mean lower costs because of the elimination of non-value-added activities such as waste, idle time, and rework.

Adjusting Standards

Standards have generally been set after comprehensive investigation of prices and quantities for the various cost elements. Traditionally, these standards were almost always retained for at least one year and, sometimes, for multiple years. Currently, the business environment (which includes suppliers, technology, competition, product design, and manufacturing methods) changes so rapidly that a standard may no longer be useful for management control purposes for an entire year.¹⁰

Company management must consider whether to incorporate changes in the environment into the standards during the year in which significant changes occur. Ignoring the changes is a simplistic approach that allows the same type of cost to be recorded at the same amount all year. Thus, for example, any material purchased during the year would be recorded at the same standard cost regardless of when the purchase was made. This approach, although making record-keeping easy, eliminates any opportunity to adequately control costs or evaluate performance. Additionally, such an approach could create large differentials between standard and actual costs, making standard costs unacceptable for external reporting.

Changing the standards to reflect price or quantity changes would make some aspects of management control and performance evaluation more effective and others more difficult. For instance, budgets prepared using the original standards would need to be adjusted before appropriate actual comparisons could be made against them. Changing of standards also creates a problem for recordkeeping and inventory valuation. At what standard cost should products be valued—the standard

⁹ Sara Moulton, Ed Oakley, and Chuck Kremer, “How to Assure Your Quality Initiative Really Pays Off,” *Management Accounting* (January 1993), p. 26.

¹⁰ According to a 1999 Institute of Management Accountants’ survey, 54 percent of companies update their standards annually and another 20 percent update them on an as-needed basis. source: Kip R. Krumwiede, “Results of 1999 Cost Management Survey: The Use of Standard Costing and Other Costing Practices,” *Cost Management Update* (December 1999/January 2000), pp. 1–4.

in effect when they were produced or the standard in effect when the financial statements are prepared? Although production-point standards would be more closely related to actual costs, many of the benefits discussed earlier in the chapter might be undermined.

If possible, management may consider combining these two choices in the accounting system. The original standards can be considered “frozen” for budget purposes and a revised budget can be prepared using the new current standards. The difference between these budgets would reflect variances related to business environment cost changes. These variances could be designated as uncontrollable (such as those related to changes in the market price of raw material) or internally initiated (such as changes in standard labor time resulting from employee training or equipment rearrangement). Comparing the budget based on current standards with actual costs would provide variances that would more adequately reflect internally controllable causes, such as excess material and/or labor time usage caused by inferior material purchases.

Price Variance Based on Purchases versus on Usage

The price variance computation has traditionally been based on purchases rather than on usage. This choice was made so as to calculate the variance as quickly as possible relative to the cost incurrence. Although calculating the price variance for material at the purchase point allows managers to see the impact of buying decisions more rapidly, such information may not be most relevant in a just-in-time environment. Buying materials in quantities that are not needed for current production requires that the materials be stored and moved, both of which are non-value-added activities. The trade-off in price savings would need to be measured against the additional costs to determine the cost-benefit relationship of such a purchase.

Additionally, computing a price variance on purchases, rather than on usage, may reduce the probability of recognizing a relationship between a favorable material price variance and an unfavorable material quantity variance. If the favorable price variance resulted from the purchase of low-grade material, the effects of that purchase will not be known until the material is actually used.

Decline in Direct Labor

As the proportion of product cost related to direct labor declines, the necessity for direct labor variance computations is minimized. Direct labor may simply become a part of a conversion cost category, as noted in Chapter 3. Alternatively, the increase in automation often relegates labor to an indirect category because workers become machine overseers rather than product producers.

CONVERSION COST AS AN ELEMENT IN STANDARD COSTING

6

How will standard costing be affected if a company uses a single conversion element rather than the traditional labor and overhead elements?

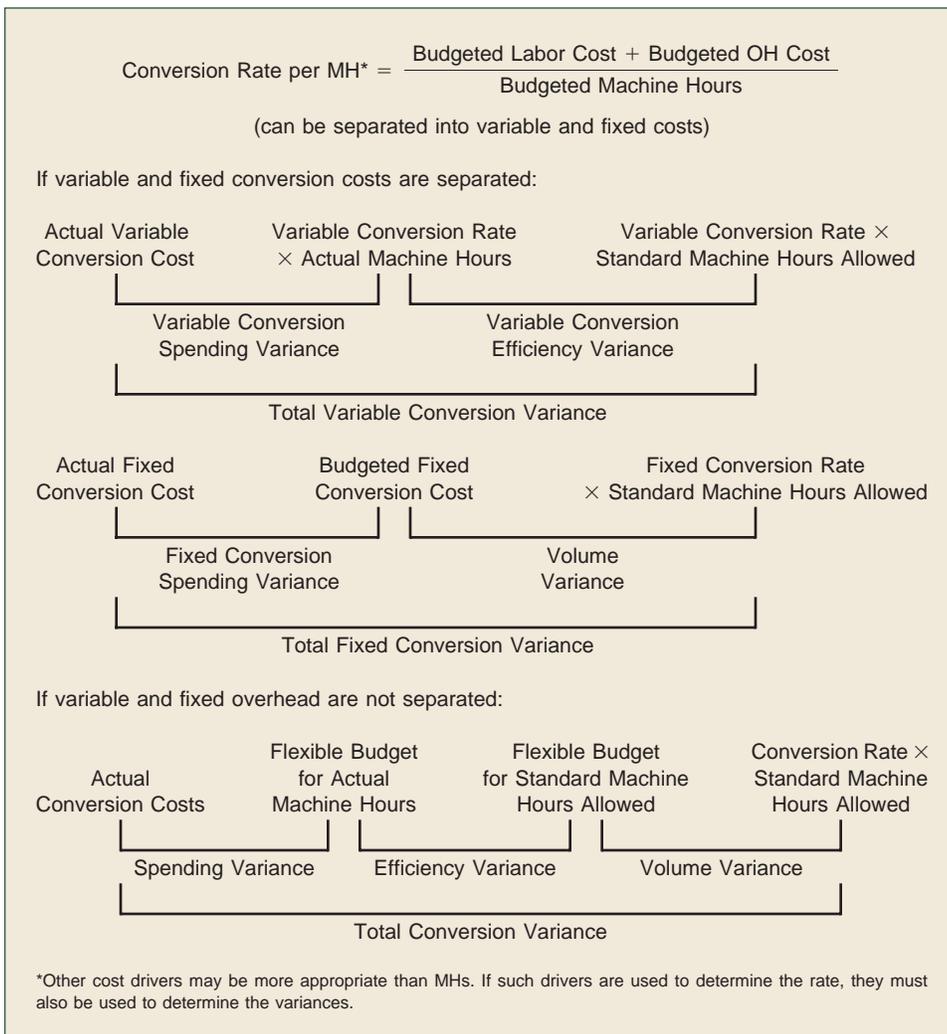
Conversion cost consists of direct labor and manufacturing overhead. The traditional view of separating product cost into three categories (direct material, direct labor, and overhead) is appropriate in a labor-intensive production setting. However, in more highly automated factories, direct labor cost generally represents only a small part of total product cost. In such circumstances, one worker might oversee a large number of machines and deal more with troubleshooting machine malfunctions than with converting raw material into finished products. These new conditions mean that workers' wages are more closely associated with indirect, rather than direct, labor.

Many companies have responded to the condition of large overhead costs and small direct labor costs by adapting their standard cost systems to provide for only two elements of product cost: direct material and conversion. In these situations, conversion costs are likely to be separated into their variable and fixed components. Conversion costs may also be separated into direct and indirect categories based on the ability to trace such costs to a machine rather than to a product. Overhead may be applied using a variety of cost drivers including machine hours, cost of material, number of production runs, number of machine setups, or throughput time.

Variance analysis for conversion cost in automated plants normally focuses on the following: (1) spending variances for overhead costs; (2) efficiency variances for machinery and production costs rather than labor costs; and (3) volume variance for production. These types of analyses are similar to the traditional three-variance overhead approach. In an automated system, managers are likely to be able to better control not only the spending and efficiency variances, but also the volume variance. The idea of planned output is essential in a just-in-time system. Variance analysis under a conversion cost approach is illustrated in Exhibit 10-10. Regardless of the method by which variances are computed, managers must analyze those variances and use them for cost control purposes to the extent that such control can be exercised.

EXHIBIT 10-10

Variances under Conversion Approach



Assume that Parkside Products makes a wrought iron park bench in a process that is fully automated and direct labor is not needed; that is, all labor required for this product is considered indirect. Conversion cost information for this product for 2001 follows:

Expected production	12,000 units
Actual production	13,000 units
Budgeted machine hours	24,000
Actual machine hours	25,000
Budgeted variable conversion cost	\$ 96,000
Budgeted fixed conversion cost	192,000
Actual variable conversion cost	97,500
Actual fixed conversion cost	201,000
Variable conversion rate: $\$96,000 \div 24,000 = \4 per MH	
Fixed conversion rate: $\$192,000 \div 24,000 = \8 per MH	
Standard machine hours = $13,000 \times 2 = 26,000$	

The variance computations for conversion costs follow.

Actual Conversion Cost	Flexible Budget Actual Hours	Flexible Budget Standard Hours	Standard Cost ($\$12 \times 26,000$)
\$298,500	\$292,000	\$296,000	\$312,000
\$6,500 U	\$4,000 F	\$16,000 F	
Spending Variance	Efficiency Variance	Volume Variance	
	\$13,500 F		
	Total Conversion Cost Variance		

<http://www.bankofamerica.com>
<http://www.bankone.com>
<http://www.firstunion.com>

REVISITING

Commerce
Bancorp

<http://www.commerceonline.com>

Commerce grew slowly at first, adding a few branches each year, and its service became a draw for the small-business customers on the lending side. By 1994, Commerce had pioneered Sunday banking, opening branches from 11 a.m. to 4 p.m. That same year, Mr. Hill took another page from the McDonald's handbook with the launch of Commerce University—modeled after Hamburger U. at McDonald's.

"We are different!" shouts John Manning, a training manager at the facility, before a room full of students. Classes cover everything from loan underwriting to counting cash. Today's course is called "Traditions," which includes basics such as answering the phone in a chirpy voice. One by one, students stand behind a screen and practice their greeting—"Hello! My name is Linda! How may I help you?!"—while the rest of the class rates the effort.

In 1994, the same year Commerce set up its training facility, legislators in Washington revised banking laws to allow interstate mergers, spurring the growth of behemoths

such as Bank of America Corp., Bank One Corp. and First Union. The top priority for these banks was to cut costs and squeeze more profits out of merged operations. Often that started with staff cuts, which hurt morale.

"It makes for a very insecure environment," says Rita O'Brien, a retired executive at a small engineering company who used to bank at First Union, but switched because of poor service and fees to Commerce. "That gets reflected back to the customer." Indeed, U.S. Transactions, a firm that researches banking markets, found that 3 out of 10 retail customers of merged banks say the merger hurt service. Most of those say they want to leave their bank.

Mr. Hill, seeing an opportunity to grow much faster, started hammering on the service message. He billed Commerce as "America's Most Convenient Bank," in an effort to steal dissatisfied customers from rivals. He advertised hours, honed teller service, and began paying his branches \$5,000 to divide among the staff each time a rival branch nearby closes its doors.

For Commerce, the challenge now is to maintain service while growing. The company spends \$100,000 on marketing each new branch opening to create a hometown feeling, and the event is a flashback to another banking era. On a recent Saturday in the Philadelphia suburb of Flourtown, the neighborhood slowly turned out to pick up free Commerce cups and pens. A magician twisted balloons, while a disk jockey spun oldies. There was a raffle and free soft drinks and hot dogs. Wayne

Gomes, a Philadelphia Phillies relief pitcher, signed photos for kids in Little League outfits.

With assets of \$7 billion, Commerce is the largest bank headquartered in southern New Jersey. Its retail approach to banking uses chain concepts that feature standardized facilities, standardized hours, standardized service, and aggressive marketing. The consistent delivery and reinforcement of this strategy for over 26 years has built a brand that the consumer has accepted as truth.

SOURCES: Jathon Sapsford, "Local McBanker: A Small Chain Grows by Borrowing Ideas from Burger Joints—Jersey's Commerce Bancorp Stretches Hours, Cuts Fees to Build Volume—The Catch: Lower Interest," *The Wall Street Journal* (May 17, 2000), p. A1; Corporate Profile Web site, <http://www.commerceonline.com> (June 16, 2000).

CHAPTER SUMMARY

A standard cost is computed as a standard price multiplied by a standard quantity. In a true standard cost system, standards are derived for prices and quantities of each product component and for each product. A standard cost card provides information about a product's standards for components, processes, quantities, and costs. The material and labor sections of the standard cost card are derived from the bill of materials and the operations flow document, respectively.

A variance is any difference between an actual and a standard cost. A total variance is composed of a price and a usage subvariance. The material variances are the price and the quantity variances. The material price variance can be computed on either the quantity of material purchased or the quantity of material used in production. This variance is computed as the quantity measure multiplied by the difference between the actual and standard prices. The material quantity variance is the difference between the standard price of the actual quantity of material used and the standard price of the standard quantity of material allowed for the actual output.

The two labor variances are the rate and efficiency variances. The labor rate variance indicates the difference between the actual rate paid and the standard rate allowed for the actual hours worked during the period. The labor efficiency variance compares the number of hours actually worked against the standard number of hours allowed for the level of production achieved and multiplies this difference by the standard wage rate.

If separate variable and fixed overhead accounts are kept (or if this information can be generated from the records), two variances can be computed for both the variable and fixed overhead cost categories. The variances for variable overhead are the VOH spending and VOH efficiency variances. The VOH spending variance is the difference between actual variable overhead cost and budgeted variable overhead based on the actual level of input. The VOH efficiency variance is the difference between budgeted variable overhead at the actual activity level and variable overhead applied on the basis of standard input quantity allowed for the production achieved.

The fixed overhead variances are the FOH spending and volume variances. The fixed overhead spending variance is equal to actual fixed overhead minus budgeted fixed overhead. The volume variance compares budgeted fixed overhead to applied fixed overhead. Fixed overhead is applied based on a predetermined rate using a selected measure of capacity. Any output capacity utilization actually achieved (measured in standard input quantity allowed), other than the level selected to determine the standard rate, will cause a volume variance to occur.

Depending on the detail available in the accounting records, a variety of overhead variances may be computed. If a combined variable and fixed overhead rate is used, companies may use a one-, two-, or three-variance approach. The one-variance approach provides only a total overhead variance, which is the difference between actual and applied overhead. The two-variance approach provides information on a budget and a volume variance. The budget variance is calculated as total actual overhead minus total budgeted overhead at the standard input quantity allowed for the production achieved. The volume variance is calculated in the same manner as under the four-variance approach. The three-variance approach calculates an overhead spending variance, overhead efficiency variance, and a volume variance. The spending variance is the difference between total actual overhead and total budgeted overhead at the actual level of activity worked. The efficiency variance is the difference between total budgeted overhead at the actual activity level and total budgeted overhead at the standard input quantity allowed for the production achieved. The volume variance is computed in the same manner as it was using the four-variance approach.

Actual costs are required for external reporting, although standard costs may be used if they approximate actual costs. Adjusting entries are necessary at the end of the period to close the variance accounts. Standards provide a degree of clerical efficiency and assist management in its planning, controlling, decision making, and performance evaluation functions. Standards can also be used to motivate employees if the standards are seen as a goal of expected performance.

A standard cost system should allow management to identify significant variances as close to the time of occurrence as feasible and, if possible, to help determine the variance cause. Significant variances should be investigated to decide whether corrective action is possible and practical. Guidelines for investigation should be developed using the management by exception principle.

Standards should be updated periodically so that they reflect actual economic conditions. Additionally, they should be set at a level to encourage high-quality production, promote cost control, and motivate workers toward production objectives.

Automated manufacturing systems will have an impact on variance computations. One definite impact is the reduction in or elimination of direct labor hours or costs for overhead application. Machine hours, production runs, and number of machine setups are examples of more appropriate activity measures than direct labor hours in an automated factory. Companies may also design their standard cost systems to use only two elements of production cost: direct material and conversion. Variances for conversion under such a system focus on machine or production efficiency rather than on labor efficiency.

APPENDIX

7

How do multiple material and labor categories affect variances?

Mix and Yield Variances

Most companies use a combination of many materials and various classifications of direct labor to produce goods. In such settings, the material and labor variance computations presented in the chapter are insufficient.

When a company's product uses more than one material, a goal is to combine those materials in such a way as to produce the desired product quality in the most cost-beneficial manner. Sometimes, materials can be substituted for one another without affecting product quality. In other instances, only one specific material or type of material can be used. For example, a furniture manufacturer might use either oak or maple to build a couch frame and still have the same basic quality. A perfume manufacturer, however, may be able to use only a specific fragrance oil to achieve a desired scent.

Labor, like materials, can be combined in many different ways to make the same product. Some combinations will be less expensive than others; some will be more efficient than others. Again, all potential combinations may not be viable: Unskilled laborers would not be able to properly cut Baccarat or Waterford crystal.

Management desires to achieve the most efficient use of labor inputs. As with materials, some amount of interchangeability among labor categories is assumed. Skilled labor is more likely to be substituted for unskilled because interchanging unskilled labor for skilled labor is often not feasible. However, it may not be cost effective to use highly skilled, highly paid workers to do tasks that require little or no training. A rate variance for direct labor is calculated in addition to the mix and yield variances.

Each possible combination of materials or labor is called a **mix**. Management's standards development team sets standards for materials and labor mix based on experience, judgment, and experimentation. Mix standards are used to calculate mix and yield variances for materials and labor. An underlying assumption in product mix situations is that the potential for substitution exists among the material and labor components. If this assumption is invalid, changing the mix cannot improve the yield and may even prove wasteful. In addition to mix and yield variances, price and rate variances are still computed for materials and labor. Consider the following example.

The Fish Place has begun packaging a frozen one-pound "Gumbo-combo" that contains processed crab, shrimp, and oysters. This new product is used to illustrate the computations of mix and yield variances. To some extent, one ingredient may be substituted for the other. In addition, it is assumed that the company uses two direct labor categories (A and B). There is a labor rate differential between these two categories. Exhibit 10-11 provides standard and actual information for the company for December 2000.

Material Price, Mix, and Yield Variances

A material price variance shows the dollar effect of paying prices that differ from the raw material standard. The **material mix variance** measures the effect of substituting a nonstandard mix of materials during the production process. The

mix

material mix variance

EXHIBIT 10-11

*Standard and Actual Information
for December 2000*

Material standards for one lot (200 1-pound packages):		
Crab:	60 pounds at \$7.20 per pound	\$ 432
Shrimp:	90 pounds at \$4.50 per pound	405
Oysters:	50 pounds at \$5.00 per pound	250
Total	<u>200 pounds</u>	<u>\$1,087</u>
Labor standards for one lot (200 1-pound packages):		
Category A workers:	20 hours at \$10.50 per hour	\$210
Category B workers:	10 hours at \$14.30 per hour	143
Total	<u>30 hours</u>	<u>\$353</u>
Actual production and cost data for December:		
Production:	40 lots	
Material:		
Crab:	Purchased and used	2,285.7 pounds at \$7.50 per pound
Shrimp:	Purchased and used	3,649.1 pounds at \$4.40 per pound
Oysters:	Purchased and used	2,085.2 pounds at \$4.95 per pound
Total		<u>8,020.0 pounds</u>
Labor:		
Category A	903 hours at \$10.50 per hour	(\$9,481.50)
Category B	387 hours at \$14.35 per hour	(\$5,553.45)
Total	<u>1,290 hours</u>	

material yield variance

material yield variance is the difference between the actual total quantity of input and the standard total quantity allowed based on output; this difference reflects standard mix and standard prices. The sum of the material mix and yield variances equals a material quantity variance similar to the one shown in the chapter; the difference between these two variances is that the sum of the mix and yield variances is attributable to multiple ingredients rather than to a single one. A company can have a mix variance without experiencing a yield variance.

yield

For Gumbo-combo, the standard mix of materials is 30 percent (60 pounds of 200 pounds per lot) crab, 45 percent shrimp, and 25 percent oysters. The **yield** of a process is the quantity of output resulting from a specified input. For Gumbo-combo, the yield from 60 pounds of crab, 90 pounds of shrimp, and 50 pounds of oysters is one lot of 200 one-pound packages. Computations for the price, mix, and yield variances are given below in a format similar to that used in the chapter:

$$\begin{array}{cccc}
 \begin{array}{c} \text{Actual Mix} \times \\ \text{Actual Quantity} \\ \times \text{Actual} \\ \text{Price} \end{array} & \begin{array}{c} \text{Actual Mix} \times \\ \text{Actual Quantity} \\ \times \text{Standard} \\ \text{Price} \end{array} & \begin{array}{c} \text{Standard Mix} \times \\ \text{Actual Quantity} \\ \times \text{Standard} \\ \text{Price} \end{array} & \begin{array}{c} \text{Standard Mix} \times \\ \text{Standard Quantity} \\ \times \text{Standard} \\ \text{Price} \end{array} \\
 \hline
 & \text{Material Price} & \text{Material Mix} & \text{Material Yield} \\
 & \text{Variance} & \text{Variance} & \text{Variance}
 \end{array}$$

Assume The Fish Place used 8,020 total pounds of ingredients to make 40 lots of Gumbo-combo. The standard quantity necessary to produce this quantity of Gumbo-combo is 8,000 total pounds of ingredients. The actual mix of crab, shrimp, and oysters was 28.5, 45.5, and 26.0 percent, respectively:

Crab	(2,285.7 pounds out of 8,020) = 28.5%
Shrimp	(3,649.1 pounds out of 8,020) = 45.5%
Oysters	(2,085.2 pounds out of 8,020) = 26.0%

Computations necessary for the material variances are shown in Exhibit 10–12. These amounts are then used to compute the variances.

EXHIBIT 10-12

Computations for Material Mix and Yield Variances

(1) Total actual data (mix, quantity, and prices):			
Crab—2,285.7 pounds at \$7.50		\$17,142.75	
Shrimp—3,649.1 pounds at \$4.40		16,056.04	
Oysters—2,085.2 pounds at \$4.95		<u>10,321.74</u>	<u>\$43,520.53</u>
(2) Actual mix and quantity; standard prices:			
Crab—2,285.7 pounds at \$7.20		\$16,457.04	
Shrimp—3,649.1 pounds at \$4.50		16,420.95	
Oysters—2,085.2 pounds at \$5.00		<u>10,426.00</u>	<u>\$43,303.99</u>
(3) Standard mix; actual quantity; standard prices:			
Crab—30% × 8,020 pounds × \$7.20		\$17,323.20	
Shrimp—45% × 8,020 pounds × \$4.50		16,240.50	
Oysters—25% × 8,020 pounds × \$5.00		<u>10,025.00</u>	<u>\$43,588.70</u>
(4) Total standard data (mix, quantity, and prices):			
Crab—30% × 8,000 pounds × \$7.20		\$17,280.00	
Shrimp—45% × 8,000 pounds × \$4.50		16,200.00	
Oysters—25% × 8,000 pounds × \$5.00		<u>10,000.00</u>	<u>\$43,480.00</u>

Actual M, Q, & P*	Actual M & Q; Standard P	Standard M; Actual Q; Standard P	Standard M, Q, & P
\$43,520.53	\$43,303.99	\$43,588.70	\$43,480.00
\$216.54 U	\$284.71 F	\$108.70 U	
Material Price Variance	Material Mix Variance	Material Yield Variance	
\$40.53 U			
Total Material Variance			

*Note: M = mix, Q = quantity, and P = price.

The above computations show a single price variance being calculated for materials. To be more useful to management, separate price variances can be calculated for each material used. For example, the material price variance for crab is \$685.71 U (\$17,142.75 – \$16,457.04), for shrimp \$364.91 F (\$16,056.04 – \$16,420.95), and for oysters \$104.26 F (\$10,321.74 – \$10,426.00). The savings on the shrimp and oysters was less than the added cost for the crab, so the total price variance was unfavorable. Also, less than the standard proportion of the most expensive ingredient (crab) was used, so it is reasonable that there would be a favorable mix variance. The company also experienced an unfavorable yield because total pounds of material allowed for output (8,000) was less than actual total pounds of material used (8,020).

Labor Rate, Mix, and Yield Variances

The two labor categories used by The Fish Place are unskilled (A) and skilled (B). When preparing the labor standards, the development team establishes the labor categories required to perform the various tasks and the amount of time each task is expected to take. During production, variances will occur if workers are not paid the standard rate, do not work in the standard mix on tasks, or do not perform those tasks in the standard time.

The labor rate variance is a measure of the cost of paying workers at other than standard rates. The **labor mix variance** is the financial effect associated with changing the proportionate amount of higher or lower paid workers in production. The **labor yield variance** reflects the monetary impact of using more or fewer total hours than the standard allowed. The sum of the labor mix and yield variances equals the labor efficiency variance. The diagram for computing labor rate, mix, and yield variances is as follows:

labor mix variance

labor yield variance

Actual Mix × Actual Hours × Actual Rate	Actual Mix × Actual Hours × Standard Rate	Standard Mix × Actual Hours × Standard Rate	Standard Mix × Standard Hours × Standard Rate
Labor Rate Variance	Labor Mix Variance	Labor Yield Variance	

Standard rates are used to make both the mix and yield computations. For Gumbo-combo, the standard mix of A and B labor shown in Exhibit 10–11 is two-thirds and one-third (20 and 10 hours), respectively. The actual mix is 70 percent (903 of 1,290) A and 30 percent (387 of 1,290) B. Exhibit 10–13 presents the labor computations for Gumbo-combo production. Because standard hours to produce one lot of Gumbo-combo were 20 and 10, respectively, for categories A and B labor, the standard hours allowed for the production of 40 lots are 1,200 (800 of A and 400 of B). Using the amounts from Exhibit 10–13, the labor variances for Gumbo-combo production in December are calculated in diagram form:

Actual M, H, & R*	Actual M & H; Standard R	Standard M; Actual H; Standard R	Standard M, H, & R
\$15,034.95	\$15,015.60	\$15,179.00	\$14,120.00
\$19.35 U	\$163.40 F	\$1,059 U	
Labor Rate Variance	Labor Mix Variance	Labor Yield Variance	
\$914.95 U			
Total Labor Variance			

*Note: M = mix, H = hours, and R = rate.

As with material price variances, separate rate variances can be calculated for each class of labor. Because category A does not have a labor rate variance, the total rate variance relates to category B.

The company has saved \$163.40 by using the actual mix of labor rather than the standard. A higher proportion of the less expensive class of labor (category A) than specified in the standard mix was used. One result of substituting a greater proportion of lower paid workers seems to be that an unfavorable yield occurred because total actual hours (1,290) were greater than standard (1,200).

Because there are trade-offs in mix and yield when component qualities and quantities are changed, management should observe the integrated nature of price, mix, and yield. The effects of changes of one element on the other two need to be considered for cost efficiency and output quality. If mix and yield can be increased by substituting less expensive resources while still maintaining quality, managers and product engineers should change the standards and the proportions of components. If costs are reduced but quality maintained, selling prices could also be reduced to gain a larger market share.

EXHIBIT 10-13

Computations for Labor Mix and Yield Variances

(1) Total actual data (mix, hours, and rates):		
Category A—903 hours at \$10.50	\$9,481.50	
Category B—387 hours at \$14.35	<u>5,553.45</u>	<u>\$15,034.95</u>
(2) Actual mix and hours; standard rates:		
Category A—903 hours at \$10.50	\$9,481.50	
Category B—387 hours at \$14.30	<u>5,534.10</u>	<u>\$15,015.60</u>
(3) Standard mix; actual hours; standard rates:		
Category A— $2/3 \times 1,290 \times \10.50	\$9,030.00	
Category B— $1/3 \times 1,290 \times \14.30	<u>6,149.00</u>	<u>\$15,179.00</u>
(4) Total standard data (mix, hours, and rates):		
Category A— $2/3 \times 1,200 \times \10.50	\$8,400.00	
Category B— $1/3 \times 1,200 \times \14.30	<u>5,720.00</u>	<u>\$14,120.00</u>

KEY TERMS

bill of material (p. 383)
 budget variance (p. 397)
 controllable variance (p. 397)

expected standard (p. 405)
 fixed overhead spending variance (p. 395)
 flexible budget (p. 392)

ideal standard (p. 406)	practical capacity (p. 392)
labor efficiency variance (p. 392)	practical standard (p. 405)
labor mix variance (p. 415)	standard cost (p. 382)
labor rate variance (p. 392)	standard cost card (p. 386)
labor yield variance (p. 415)	standard quantity allowed (p. 389)
material price variance (p. 389)	theoretical capacity (p. 392)
material quantity variance (p. 391)	total overhead variance (p. 396)
material mix variance (p. 413)	total variance (p. 387)
material yield variance (p. 414)	variable overhead efficiency variance
mix (p. 413)	(p. 395)
noncontrollable variance (p. 395)	variable overhead spending variance
normal capacity (p. 392)	(p. 394)
operations flow document (p. 385)	variance analysis (p. 402)
overhead efficiency variance (p. 397)	volume variance (p. 395)
overhead spending variance (p. 397)	yield (p. 414)

SOLUTION STRATEGIES

Actual Costs

Direct Material: Actual Price \times Actual Quantity Purchased or Used
 $DM: AP \times AQ = AC$

Direct Labor: Actual Price (Rate) \times Actual Quantity of Hours Worked
 $DL: AP \times AQ = AC$

Standard Costs

Direct Material: Standard Price \times Standard Quantity Allowed
 $DM: SP \times SQ = SC$

Direct Labor: Standard Price (Rate) \times Standard Quantity of Hours Allowed
 $DL: SP \times SQ = SC$

Standard Quantity Allowed: Standard Quantity of Input (SQ) \times Actual Quantity of Output Achieved

Variations in Formula Format

The following abbreviations are used:

AFOH = actual fixed overhead

AM = actual mix

AP = actual price or rate

AQ = actual quantity or hours

AVOH = actual variable overhead

BFOH = budgeted fixed overhead (remains at constant amount regardless of activity level as long as within the relevant range)

SM = standard mix

SP = standard price

SQ = standard quantity

TAOH = total actual overhead

Material price variance = $(AP \times AQ) - (SP \times AQ)$

Material quantity variance = $(SP \times AQ) - (SP \times SQ)$

Labor rate variance = $(AP \times AQ) - (SP \times AQ)$

Labor efficiency variance = $(SP \times AQ) - (SP \times SQ)$

Four-variance approach:

$$\begin{aligned} \text{Variable OH spending variance} &= \text{AVOH} - (\text{VOH rate} \times \text{AQ}) \\ \text{Variable OH efficiency variance} &= (\text{VOH rate} \times \text{AQ}) - (\text{VOH rate} \times \text{SQ}) \\ \text{Fixed OH spending variance} &= \text{AFOH} - \text{BFOH} \\ \text{Volume variance} &= \text{BFOH} - (\text{FOH rate} \times \text{SQ}) \end{aligned}$$

Three-variance approach:

$$\begin{aligned} \text{Spending variance} &= \text{TAOH} - [(\text{VOH rate} \times \text{AQ}) + \text{BFOH}] \\ \text{Efficiency variance} &= [(\text{VOH rate} \times \text{AQ}) + \text{BFOH}] - [(\text{VOH rate} \times \text{SQ}) + \text{BFOH}] \\ \text{Volume variance} &= [(\text{VOH rate} \times \text{SQ}) + \text{BFOH}] - [(\text{VOH rate} \times \text{SQ}) + (\text{FOH rate} \times \text{SQ})] \text{ (This is equal to the volume variance of the four-variance approach.)} \end{aligned}$$

Two-variance approach:

$$\begin{aligned} \text{Budget variance} &= \text{TAOH} - [(\text{VOH rate} \times \text{SQ}) + \text{BFOH}] \\ \text{Volume variance} &= [(\text{VOH rate} \times \text{SQ}) + \text{BFOH}] - [(\text{VOH rate} \times \text{SQ}) + (\text{FOH rate} \times \text{SQ})] \text{ (This is equal to the volume variance of the four-variance approach.)} \end{aligned}$$

One-variance approach:

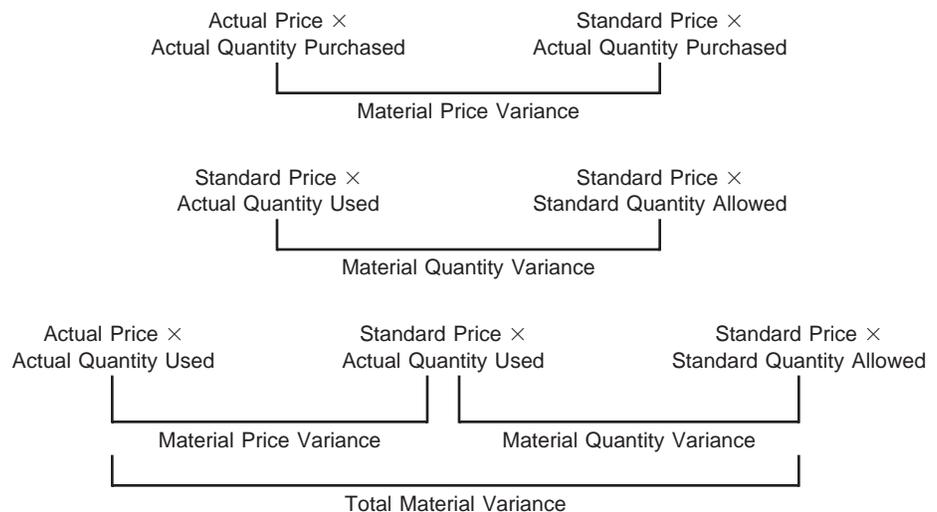
$$\text{Total OH variance} = \text{TAOH} - (\text{Combined OH rate} \times \text{SQ})$$

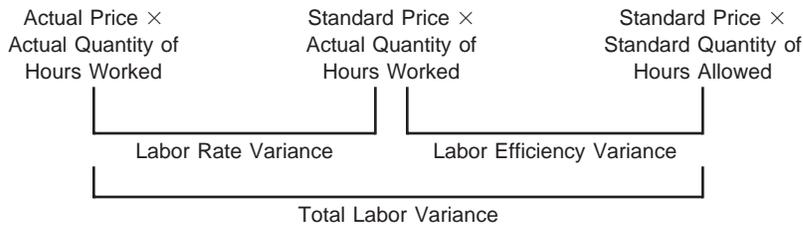
MULTIPLE MATERIALS:

$$\begin{aligned} \text{Material price variance} &= (\text{AM} \times \text{AQ} \times \text{AP}) - (\text{AM} \times \text{AQ} \times \text{SP}) \\ \text{Materials mix variance} &= (\text{AM} \times \text{AQ} \times \text{SP}) - (\text{SM} \times \text{AQ} \times \text{SP}) \\ \text{Materials yield variance} &= (\text{SM} \times \text{AQ} \times \text{SP}) - (\text{SM} \times \text{SQ} \times \text{SP}) \end{aligned}$$

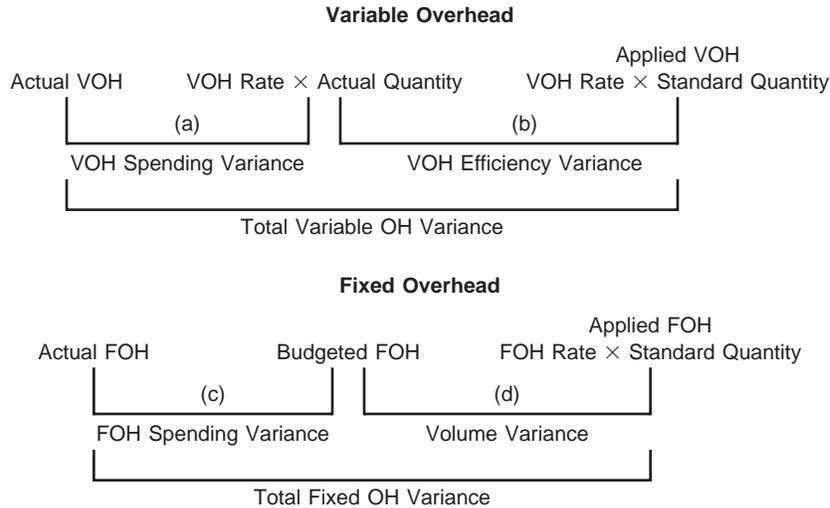
MULTIPLE LABOR CATEGORIES:

$$\begin{aligned} \text{Labor rate variance} &= (\text{AM} \times \text{AQ} \times \text{AP}) - (\text{AM} \times \text{AQ} \times \text{SP}) \\ \text{Labor mix variance} &= (\text{AM} \times \text{AQ} \times \text{SP}) - (\text{SM} \times \text{AQ} \times \text{SP}) \\ \text{Labor yield variance} &= (\text{SM} \times \text{AQ} \times \text{SP}) - (\text{SM} \times \text{SQ} \times \text{SP}) \end{aligned}$$

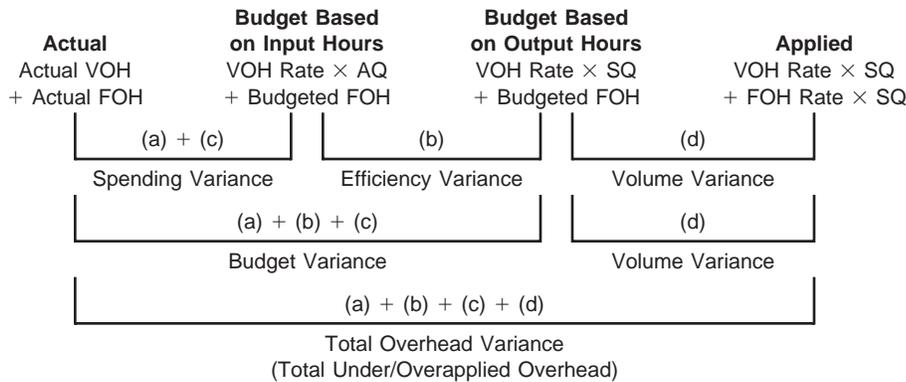
VARIANCES IN DIAGRAM FORMAT:**Direct Materials and Direct Labor**



Overhead four-variance approach:



Overhead one-, two-, and three-variance approaches:



Mix and Yield Variances

MULTIPLE MATERIALS:



MULTIPLE LABOR CATEGORIES:



DEMONSTRATION PROBLEM

Poly Containers makes 300-gallon plastic water tanks for a variety of commercial uses. The standard per unit material, labor, and overhead costs are as follows:

Direct material: 80 pounds @ \$2	\$160
Direct labor: 1.25 hours @ \$16 per hour	20
Variable overhead: 30 minutes of machine time @ \$50.00 per hour	25
Fixed overhead: 30 minutes of machine time @ \$40.00 per hour	20

The overhead application rates were developed using a practical capacity of 6,000 units per year. Production is assumed to occur evenly throughout the year.

During May 2001, the company produced 525 tanks. Actual data for May 2001 are as follows:

Direct material purchased: 46,000 pounds @ \$1.92 per pound
 Direct material used: 43,050 pounds (all from May's purchases)
 Total labor cost: \$10,988.25 for 682.5 hours
 Variable overhead incurred: \$13,770 for 270 hours of machine time
 Fixed overhead incurred: \$10,600 for 270 hours of machine time

Required:

Calculate the following:

- a. Material price variance based on purchases
- b. Material quantity variance
- c. Labor rate variance
- d. Labor efficiency variance
- e. Variable overhead spending and efficiency variances
- f. Fixed overhead spending and volume variances
- g. Overhead variances using a three-variance approach
- h. Overhead variances using a two-variance approach
- i. Overhead variance using a one-variance approach

Solution to Demonstration Problem

a.

$AP \times AQ_p$	$SP \times AQ_p$
$\$1.92 \times 46,000$	$\$2.00 \times 46,000$
$\$88,320$	$\$92,000$
<div style="display: flex; justify-content: space-between; width: 100%;"> </div>	
$\$3,680 \text{ F}$	
MPV	

b.

$SQ = 525 \times 80 \text{ pounds} = 42,000 \text{ pounds}$

$SP \times AQ_u$	$SP \times SQ$
$\$2 \times 43,050$	$\$2 \times 42,000$
$\$86,100$	$\$84,000$
<div style="display: flex; justify-content: space-between; width: 100%;"> </div>	
$\$2,100 \text{ U}$	
MQV	

c. & d.

$AR = \$10,988.25 \div 682.5 \text{ hours} = \16.10 per hour

$SQ = 525 \times 1.25 \text{ hours} = 656.25 \text{ hours}$

$AP \times AQ$	$SP \times AQ$	$SP \times SQ$
$\$16.10 \times 682.5$	$\$16 \times 682.5$	$\$16 \times 656.25$
$\$10,988.25$	$\$10,920$	$\$10,500$
<div style="display: flex; justify-content: space-between; width: 100%;"> </div>		<div style="border-top: 1px solid black; width: 100%;"></div>
$\$68.25 \text{ U}$		$\$420 \text{ U}$
LRV		LEV

e. $SQ = 525 \times 0.5 = 262.5$ hours

Actual VOH \$13,770	SP × AQ \$50.00 × 270 \$13,500	SP × SQ \$50.00 × 262.5 \$13,125
\$270 U		\$375 U
VOH Spending Variance		VOH Efficiency Variance

f. BFOH, annually = $6,000 \times \$20 = \$120,000$
 BFOH, monthly = $\$120,000 \div 12 \text{ months} = \$10,000$
 SQ = 262.5 hours [from part (e)].

Actual FOH \$10,600	Budgeted FOH \$10,000	SP × SQ \$40 × 262.50 \$10,500
\$600 U		\$500 F
FOH Spending Variance		Volume Variance

g., h., and i. Combined overhead application rate = $\$50 + \$40 = \$90$ per MH;
 SQ = 262.5 hours [from part (e)].

Actual VOH + Actual FOH	VOH Rate × AQ + Budgeted FOH	VOH Rate × SQ + Budgeted FOH	Applied OH (SP × SQ)
\$13,770	\$50 × 270 = \$13,500	\$50 × 262.5 = \$13,125	\$50 × 262.5 = \$13,125
+ 10,600	+ 10,000	+ 10,000	+ 40 × 262.5 = 10,500
\$24,370	\$23,500	\$23,125	\$90 × 262.5 = \$23,625
\$870 U		\$375 U	\$500 F
Spending Variance		Efficiency Variance	Volume Variance

Actual OH \$24,370	VOH Rate × SQ + Budgeted FOH	Applied OH (SP × SQ)
	\$50 × 262.50 = \$13,125	\$90 × 262.50 = \$23,625
	+ 10,000	
	\$23,125	
\$1,245 U		\$500 F
Budget Variance		Volume Variance

Actual OH \$24,370	Applied OH SP × SQ
	\$90 × 262.50 = \$23,625
\$745 U	
Total Overhead Variance (Total Under/Overapplied Overhead)	

QUESTIONS

1. What are the three primary uses of a standard cost system? In a business that routinely manufactures the same products or performs the same services, why would standards be helpful?
2. The standards development team should be composed of what experts? Why are these people included?
3. Discuss the development of standards for a material. How is the quality standard established for a material?

4. What is a standard cost card? What information is contained on it? How does it relate to a bill of materials and an operations flow document?
5. Why are the quantities shown in the bill of materials not always the same quantities shown in the standard cost card?
6. A total variance can be calculated for each cost component of a product. Into what variances can this total be separated and to what does each relate? (Discuss separately for material and labor.)
7. What is meant by the term *standard hours*? Does the term refer to inputs or outputs?
8. Why are the overhead spending and overhead efficiency variances said to be controllable? Is the volume variance controllable? Why or why not?
9. How are actual and standard costs recorded in a standard cost system?
10. “Unfavorable variances will always have debit balances, whereas favorable variances will always have credit balances.” Is this statement true or false? Why?
11. How are immaterial variances closed at the end of an accounting period? How are significant variances closed at the end of an accounting period? Why is there a difference in treatment?
12. What is meant by the process of “management by exception”? How is a standard cost system helpful in such a process?
13. Discuss the three types of standards with regard to the level of rigor of attainment. Why are some companies currently adopting the most rigorous standard?
14. Why might traditional methods of setting standards lead to less than desirable material resource management and employee behavior?
15. Why do managers care about the utilization of capacity? Are they controlling costs when they control utilization?
16. How are variances used by managers in their efforts to control costs?
17. Fixed overhead costs are generally incurred in lump-sum amounts. What implications does this have for control of fixed overhead?
18. Can combined overhead rates be used for control purposes? Are such rates more or less appropriate than separate overhead rates? Discuss.
19. Which overhead variance approach (two-variance, three-variance, or four-variance) provides the most information for cost control purposes? Why?
20. Why are some companies replacing the two traditional cost categories of direct labor and manufacturing overhead with a “conversion cost” category?
21. How has automation affected standard costing? How has automation affected the computation of variances?
22. (*Appendix*) What variances can be computed for direct material and direct labor when some materials or labor inputs are substitutes for others? What information does each of these variances provide?

EXERCISES

23. (*Direct material variances*) Iron Eagle makes wrought iron table and chair sets. During April 2001, the purchasing agent bought 12,800 pounds of scrap iron at \$0.89 per pound. Each set requires a standard quantity of 35 pounds at a standard cost of \$0.85 per pound. During April, the company used 10,700 pounds and produced 300 sets.
 - a. For April, compute the direct material price variance (based on the quantity purchased) and the direct material quantity variance.
 - b. Identify the titles of individuals in the firm who would be responsible for each of the variances.
 - c. Identify some potential explanations for the variances computed in part (a).

24. (*Direct material variances*) In August 2001, East Publishing Company's costs and quantities of paper consumed in manufacturing its 2002 Executive Planner and Calendar were as follow:



Actual unit purchase price	\$0.16 per page
Standard quantity allowed for good production	195,800 pages
Actual quantity purchased during August	230,000 pages
Actual quantity used in August	200,000 pages
Standard unit price	\$0.15 per page

- Calculate the total cost of purchases for August.
 - Compute the material price variance (based on quantity purchased).
 - Calculate the material quantity variance.
25. (*Direct labor variances*) Nelson Prefabricated Walls builds standard prefabricated wooden frames for apartment walls. The standard quantity of direct labor is 5 hours for each frame at an average standard hourly wage of \$22. During May 2001, the company produced 630 frames. The payroll records indicated that the carpenters worked 3,100 hours and earned \$71,300.
- What were the standard hours allowed for May construction?
 - Calculate the direct labor variances.
26. (*Direct labor variances*) In auditing the inventory account of a client, the accounting firm of Freeman and Associates set the following standard: 300 hours at an hourly rate of \$45. The firm actually worked 270 hours auditing inventory. The total labor variance for the inventory audit was \$0.
- Compute the total actual payroll.
 - Compute the labor efficiency variance.
 - Compute the labor rate variance.
 - Offer a brief explanation that is consistent with the two variances.
27. (*Direct material and direct labor variances*) Lisa Scamponi Ltd. produces evening bags. In December 2001, Ms. Scamponi, president of the company, received the following information from Antonio Buffa, the new controller, in regard to November production:



Production during month	1,200 handbags
Actual cost of material purchased and used	\$4,767.18
Standard material allowed	1/3 square yard per bag
Material quantity variance	\$594 U
Actual hours worked	2,520
Standard labor time per handbag	2 hours
Labor rate variance	\$630 F
Standard labor rate per hour	\$7
Standard price per yard of material	\$8

Ms. Scamponi asked Mr. Buffa to provide her with the following specific information:

- The standard quantity of material allowed for November production
 - The standard direct labor hours allowed for November production
 - The material price variance
 - The labor efficiency variance
 - The standard prime (direct material and direct labor) cost to produce one bag
 - The actual cost to produce one bag in November
 - An explanation for the difference between standard and actual cost. Be sure the explanation is consistent with the pattern of the variances.
28. (*Missing information for materials and labor*) For each of the independent cases, fill in the missing figures.

	Case A	Case B	Case C	Case D
Units produced	800	?	240	1,500
Standard hours per unit	3	0.8	?	?
Standard hours allowed	?	600	480	?
Standard rate per hour	\$7	?	\$9.50	\$6
Actual hours worked	2,330	675	?	4,875
Actual labor cost	?	?	\$4,560	\$26,812.50
Labor rate variance	\$466F	\$1,080F	\$228U	?
Labor efficiency variance	?	\$780U	?	\$2,250U

29. (*Four-variance approach; journal entries*) For 2001, Blankly Manufacturing has set 60,000 direct labor hours as the annual capacity measure for computing its predetermined variable overhead rate. At that level, budgeted variable overhead costs are \$270,000. The company has decided to apply fixed overhead on the basis of machine hours. Total budgeted annual machine hours are 3,300 and annual budgeted fixed overhead is \$118,800. Both machine hours and fixed overhead costs are expected to be incurred evenly each month.

During March 2001, Blankly incurred 4,900 direct labor hours and 250 machine hours. Variable and fixed overhead were, respectively, \$21,175 and \$10,500. The standard times allowed for March production were 4,955 direct labor hours and 240 machine hours.

- Using the four-variance approach, determine the overhead variances for March 2001.
- Prepare all journal entries for Blankly Manufacturing for March 2001.



30. (*Computation of all overhead variances*) The manager of the Automobile Registration Division of the state of Nebraska has determined that it typically takes 30 minutes for the department's employees to register a new car. The following predetermined overhead costs are applicable to Lancaster County. Fixed overhead, computed on an estimated 4,000 direct labor hours, is \$8 per DLH. Variable overhead is estimated at \$3 per DLH.

During July 2001, 7,600 cars were registered in Lancaster County, taking 3,700 direct labor hours. For the month, variable overhead was \$10,730 and fixed overhead was \$29,950.

- Compute overhead variances using a four-variance approach.
 - Compute overhead variances using a three-variance approach.
 - Compute overhead variances using a two-variance approach.
31. (*Missing data, three-variance approach*) The flexible budget formula for total overhead for the Windlass Corporation is \$720,000 + \$16 per direct labor hour. The combined overhead rate is \$40 per direct labor hour. The following data have been recorded for the year:

Actual total overhead	\$1,160,000
Total overhead spending variance	\$ 32,000 U
Volume variance	\$ 48,000 U

Use a three-variance approach to determine the following:

- Number of standard hours allowed
 - Actual direct labor hours worked
32. (*Variances and cost control*) North Diamond Inc. applies overhead on a direct labor hour basis. Each unit of product requires 12 machine hours. Overhead is applied on a 30 percent variable and 70 percent fixed basis; the overhead application rate is \$40 per hour. Standards are based on a normal monthly capacity of 24,000 machine hours.

During September 2001, North Diamond produced 2,300 units of product and incurred 25,000 machine hours. Actual overhead cost for the month was \$1,000,000.

- a. What were standard hours allowed for September?
- b. What is total annual budgeted fixed overhead cost?
- c. What is the controllable overhead variance?
- d. What is the noncontrollable overhead variance?

33. (*Journal entries*) Miami Chemical had the following balances in its trial balance at year-end 2001:



	Debit	Credit
Direct Material Inventory	\$ 36,600	
Work in Process Inventory	43,920	
Finished Goods Inventory	65,880	
Cost of Goods Sold	585,600	
Material Price Variance	7,250	
Material Quantity Variance		\$10,925
Labor Rate Variance		1,200
Labor Efficiency Variance	4,390	
VOH Spending Variance		3,600
VOH Efficiency Variance	200	
FOH Spending Variance	650	
Volume Variance	1,375	

Assume that the variances, taken together, are believed to be significant. Prepare the journal entries to dispose of the variances.

34. (*Variances and conversion cost category*) Baltimore Brake makes brake rotors. Until recently, the company used a standard cost system and applied overhead to production based on direct labor hours. The company automated its facilities in March 2001 and revamped its accounting system so that there are only two cost categories: direct material and conversion. Estimated variable conversion costs for April 2001 were \$170,000, and estimated fixed conversion costs were \$76,000; machine hours were estimated at 10,000 for April. Expected output for April was 5,000 rotors. In April, the firm actually used 9,000 machine hours to make 4,800 rotors. The firm incurred conversion costs totaling \$230,000; \$150,000 of this amount was variable cost.
- a. Using the four-variance approach, compute the variances for conversion costs in April.
 - b. Evaluate the effectiveness of the firm in controlling costs in April.
35. (*Appendix*) Genine Nut Company produces 12-ounce cans of mixed pecans and cashews. Standard and actual information follows.

Standard quantities and costs (12-oz. can):

Pecans: 6 ounces at \$3.00 per pound	\$1.125
Cashews: 6 ounces at \$4.00 per pound	1.500

Actual quantities and costs for February 2001 when production was 18,000, 12-oz. cans:

Pecans: 7,473 pounds at \$2.90 per pound
Cashews: 6,617 pounds at \$4.25 per pound

Determine the material price, mix, and yield variances.

36. (*Appendix*) Righting Moment Inc. is a mechanical engineering firm. The firm employs both engineers and draftspeople. The average hourly rates are \$80 for engineers and \$40 for draftspeople. For one project, the standard was set at 375 hours of engineer time and 625 hours of draftsperson time. Actual hours worked on this project were:

Engineers—500 hours at \$85 per hour
Draftspeople—500 hours at \$42.00 per hour

Determine the labor rate, mix, and yield variances for this project.

- 37.** *(Developing standard cost card and discussion)* The Frozen Fruitcup Company is a small producer of fruit-flavored frozen desserts. For many years, Frozen Fruitcup products have had strong regional sales on the basis of brand recognition; however, other companies have begun marketing similar products in the area, and price competition has become increasingly important. Tanya Morse, the company's controller, is planning to implement a standard cost system for Frozen Fruitcup and has gathered considerable information from her coworkers on production and material requirements for the company's products. Morse believes that the use of standard costing will allow the firm to improve cost control and make better pricing decisions.

Frozen Fruitcup's most popular product is raspberry sherbet. The sherbet is produced in 10-gallon batches, and each batch requires 6 quarts of good raspberries. The fresh raspberries are sorted by hand before they enter the production process. Because of imperfections in the raspberries and normal spoilage, 1 quart of berries is discarded for every 4 quarts of acceptable berries. The standard direct labor time is 3 minutes for the sorting that is required to obtain 1 quart of acceptable raspberries. The acceptable raspberries are then blended with the other ingredients; blending requires 12 minutes of direct labor time per batch. During blending, there is some loss of material. After blending, the sherbet is packaged in quart containers. Morse has gathered the following cost information:

- Frozen Fruitcup purchases raspberries at a cost of \$0.80 per quart.
 - All other ingredients cost a total of \$0.45 per gallon.
 - Direct labor is paid at the rate of \$9.00 per hour.
 - The total cost of material and labor required to package the sherbet is \$0.38 per quart.
- a.** Develop the standard cost for the direct cost components of a 10-gallon batch of raspberry sherbet. The standard cost should identify the standard quantity, the standard rate, and the standard cost per batch for each direct cost component of a batch of raspberry sherbet.
- b.** As part of the implementation of a standard cost system at the company, Morse plans to train those responsible for maintaining the standards on how to use variance analysis. She is particularly concerned with the causes of unfavorable variances.
- 1.** Discuss the possible causes of unfavorable material price variances, and identify the individual(s) who should be held responsible for these variances.
 - 2.** Discuss the possible causes of unfavorable labor efficiency variances, and identify the individual(s) who should be held responsible for these variances. *(CMA adapted)*

- 38.** *(Behavioral implications of standard costing)* Contact a local company that uses a standard cost system. Make an appointment with a manager at that company to interview him or her on the following issues:

- The characteristics that should be present in a standard cost system to encourage positive employee motivation
- How a standard cost system should be implemented to positively motivate employees
- What "management by exception" is and how variance analysis often results in the use of management by exception
- How employee behavior could be adversely affected when "actual to standard" comparisons are used as the basis for performance evaluation

Prepare a paper and an oral presentation based on your interview.

39. (*Flexible budget, variances, and cost control*) Overland Corp. planned to produce at the 8,000-unit level for its single type of product. Because of unexpected demand, the firm actually operated at the 8,800-unit level. The company's flexible budget appears as follows:

	6,000 units	8,000 units	10,000 units
Overhead costs:			
Variable	\$24,000	\$32,000	\$40,000
Fixed	<u>16,000</u>	<u>16,000</u>	<u>16,000</u>
Total	<u>\$40,000</u>	<u>\$48,000</u>	<u>\$56,000</u>

Actual costs incurred in producing the 8,800 units:

Variable	\$34,320
Fixed	<u>16,400</u>
Total	<u>\$50,720</u>

The production manager was upset because the company planned to incur \$48,000 of costs and actual costs were \$50,720. Prepare a memo to the production manager regarding the following questions.

- Was it correct to compare the \$50,720 to the \$48,000 for cost control purposes?
 - Analyze the costs and explain where the company did well or poorly in controlling its costs.
40. (*Standard setting; team project*) As a four-person team, choose an activity that is commonly performed every day, such as taking a shower/bath, preparing a meal, or doing homework. Have each team member time himself/herself performing that activity for two days and then develop a standard time for the team. Now have the team members time themselves performing the same activity for the next five days.
- Using an assumed hourly wage rate of \$12, calculate the labor efficiency variance for your team.
 - Prepare a list of reasons for the variance.
 - How could some of the variance have been avoided?
41. (*Cost control evaluation*) The Arizona Concrete Company makes precast concrete steps for use with manufactured housing. The plant had the following 2001 budget based on expected production of 3,200 units:

	Standard Cost	Amount Budgeted
Direct material	\$22.00	\$ 70,400
Direct labor	12.00	38,400
Variable overhead:		
Indirect material	4.20	13,440
Indirect labor	1.75	5,600
Utilities	1.00	3,200
Fixed overhead:		
Supervisory salaries		40,000
Depreciation		15,000
Insurance		<u>9,640</u>
Total		<u>\$195,680</u>

$$\text{Cost per unit} = \$195,680 \div 3,200 = \$61.15$$

Actual production for 2001 was 3,500 units, and actual costs for the year were as follows:

Direct material used	\$ 80,500
Direct labor	42,300
Variable overhead:	
Indirect material	14,000
Indirect labor	6,650
Utilities	3,850
Fixed overhead:	
Supervisory salaries	41,000
Depreciation	15,000
Insurance	8,800
Total	<u>\$212,100</u>

$$\text{Cost per unit} = \$212,100 \div 3,500 = \$60.60$$

The plant manager, John Wessly, whose annual bonus includes (among other factors) 20 percent of the net favorable cost variances, states that he saved the company \$1,925 $[(\$61.15 - \$60.60) \times 3,500]$. He has instructed the plant cost accountant to prepare a detailed report to be sent to corporate headquarters comparing each component's actual per-unit cost with the per-unit amounts set forth above in the annual budget to prove the \$1,925 cost savings.

- a. Is the actual-to-budget comparison proposed by Wessly an appropriate one? If Wessly's comparison is not appropriate, prepare a more appropriate comparison.
 - b. How would you, as the plant cost accountant, react if Wessly insisted on his comparison? Suggest what alternatives are available to you.
42. (*Appendix*) Buffin Legal Services has three labor classes: secretaries, paralegals, and attorneys. The standard wage rates are shown in the standard cost system as follows: secretaries, \$25 per hour; paralegals, \$40 per hour; and attorneys, \$85 per hour. The firm has established a standard of 0.5 hours of secretarial time and 2 hours of paralegal time for each hour of attorney time in probate cases. The actual direct labor hours worked on probate cases and the standard hours allowed for the work accomplished for one month in 2001 were as follows:

	Actual DLHS	Standard Hours for Output Achieved
Secretarial	500	500
Paralegal	1,800	2,000
Attorney	1,100	1,000

- a. Calculate the amount of the direct labor efficiency variance for the month and decompose the total into the following components:
 1. Direct labor mix variance
 2. Direct labor yield variance
- b. Prepare a memo addressing whether management used an efficient mix of labor. *(CMA adapted)*

PROBLEMS

43. (*Material and labor variances*) Mississippi Marine uses a standard cost system for materials and labor in producing fishing boats. Production requires three materials: fiberglass, paint, and a prepurchased trim package. The standard costs and quantities for materials and labor are as follows:

Standards for 1 Fishing Boat

2,500 pounds of fiberglass @ \$0.80 per pound	\$2,000
6 quarts gel coat paint @ \$60.00 per gallon	90
1 trim package	400
40 hours of labor @ \$25.00 per hour	1,000
Prime standard cost	<u>\$3,490</u>

During July 2001, the company recorded the following actual data related to the production of 300 boats:

Material Purchased:

Fiberglass—820,000 pounds @ \$0.83 per pound
 Paint—500 gallons @ \$55.50 per gallon
 Trim packages—320 @ \$405 per package

Material Used:

Fiberglass—790,000 pounds
 Paint—462 gallons
 Trim packages—304

Direct Labor Used:

12,100 hours @ \$23.50 per hour

Calculate the material and labor variances for Mississippi Marine for July 2001. Base the material price variance on the quantity of material purchased.

44. (*Variance calculation and journal entries*) Montreal Toy Co. makes small plastic toys. Standard quantities and standard costs follow for material and labor.

	Standard Quantity	Standard Cost
Material	1/2 pound	\$4 per pound (\$2.00 per unit of output)
Labor	12 minutes	\$16 per hour (\$3.20 per unit of output)

During October 2001, 50,000 toys were produced. The purchasing agent bought 29,000 pounds of material during the month at \$4.13 per pound. October payroll for the factory revealed direct labor cost of \$160,680 on 10,300 direct labor hours. During the month, 26,300 pounds of raw material were used in production.

- Compute material and labor variances, basing the material price variance on the quantity of material purchased.
 - Assuming a perpetual inventory system, prepare general journal entries for the month.
45. (*Incomplete data*) Surgical Supply manufactures latex surgical gloves. It takes 0.85 square feet of latex to manufacture a pair of gloves. The standard price for material is \$0.80 per square foot. Most processing is done by machine; the only labor required is for operators, who are paid \$25 per hour. The machines can produce 400 pairs of gloves per hour.

During one week in May, Surgical produced 30,000 pairs of gloves and experienced a \$1,500 unfavorable material quantity variance. The company had purchased 1,500 more square feet of material than it used in production that week, producing an unfavorable price variance of \$570. Based on 77 total actual labor hours to produce the gloves, a \$104 favorable total labor variance was generated. Determine the following amounts:

- Standard quantity of material
- Actual quantity of material used

(continued)

- c. Actual quantity of material purchased
 - d. Actual price of material purchased
 - e. Standard hours allowed for production
 - f. Labor efficiency variance
 - g. Labor rate variance
 - h. Actual labor rate
46. (*Incomplete data*) Learning Products, Inc., makes wooden lap desks. A small fire on October 1 partially destroyed the books and records relating to September's production. The charred remains of the standard cost card appear below.

	Standard Quantity	Standard Price
Direct material.....	5.0 board feet	
Direct labor.....		\$12.50 per hour

From other fragments of records and several discussions with employees, you learn the following:

1. The standard quantity of material used in September was 4,000 board feet.
 2. The September payroll for direct labor was \$19,220 based on 1,550 actual hours worked.
 3. The production supervisor distinctly remembered being held accountable for 50 more hours of direct labor than should have been worked. She was upset because top management failed to consider that she saved several hundred board feet of material by creative efforts that required extra time.
 4. The purchasing agent's files showed that 4,300 board feet had been purchased and used in September at \$2.05 per board foot. She was proud of the fact that this price was \$0.05 below standard cost per foot.
- a. How many units were produced during September?
 - b. Calculate all variances for direct material and direct labor for September.
 - c. What is the standard number of hours allowed for the production of each unit?
 - d. Prepare general journal entries reflecting direct material and direct labor activity and variances for September, assuming a standard cost, perpetual inventory system.
47. (*Adjusting standards*) Maui Muumuus manufactures traditional Hawaiian dresses. The company was started early in 1995, and the following standards for materials and labor were developed at that time:

Material	3 yards at \$6 per yard
Labor	1.5 hours at \$10 per hour

In May 2001, Maui Muumuus hired a new cost accountant, Sally Rogers. At the end of May, Sally was reviewing the variances calculated for the month and was amazed to find that standards had never been revised since the company started. Actual data for May 2001 for material and labor are as follows:

Material	Purchased, 50,000 yards at \$7.00 Used in production of 17,200 muumuus, 50,000 yards
Labor	17,800 hours at \$13.50 per hour

Since 1995, material prices have risen 4 percent each year. However, the company can now buy at 94 percent of regular price due to the increased volume of purchases. Labor contracts have specified a 5 percent cost-of-living adjustment for each year, beginning in 1996. Because of revising the plant layout and purchasing more efficient machinery, the labor time per muumuu has decreased by one-third; also, direct material waste has been reduced from 1/4 yard to 1/8 yard per muumuu.

- a. Determine the material and labor variances based on the standards originally designed for the company.
 - b. Determine the new standards against which Sally should measure the May 2001 results. (Round adjustments annually to the nearest penny.)
 - c. Compute the variances for material and labor using the revised standards.
48. (*Calculation of four variances*) Candy's Ceramics utilizes a standard cost system. Data for October are presented below:

Standard Cost per Unit (1 Unit Takes 1 Labor Hour)	
Direct material	\$ 9.00
Direct labor	15.00
Variable overhead	8.00
Fixed overhead	<u>16.00</u>
Total	<u>\$48.00</u>

The fixed overhead charge is based on an expected monthly capacity of 3,000 units, but due to a fire on the production floor, the company only produced 1,900 units. Actual variable overhead was \$16,000 and actual fixed overhead was \$44,000. The company recorded 2,000 direct labor hours for the month.

- a. Compute and compare the actual overhead cost per unit with the expected overhead cost per unit.
 - b. Calculate overhead variances using the four-variance method.
49. (*Four-variance approach; journal entries*) Laramie Lumber produces picnic tables, swings, and benches and uses direct labor hours to apply overhead. Standard hours allowed for each product are as follows:

Picnic table:	10 standard direct labor hours
Swing:	3 standard direct labor hours
Bench:	12 standard direct labor hours

The standard variable overhead rate is \$4 per direct labor hour; the standard fixed overhead application rate at expected annual capacity is \$2 per direct labor hour. Expected capacity on a monthly basis is 3,000 direct labor hours.

Production for June 2001 was 100 picnic tables, 400 swings, and 60 benches. Actual direct labor hours incurred were 3,020. Actual variable overhead was \$11,900, and actual fixed overhead was \$6,100 for the month.

- a. Prepare a variance analysis using the four-variance approach. (*Hint: Convert the production of each type of product into standard hours allowed for all work accomplished for the month.*)
 - b. Prepare journal entries for (1) incurring overhead costs, (2) applying overhead costs, and (3) closing the variance accounts (assume immaterial variances).
 - c. Evaluate the effectiveness of managers in controlling costs.
50. (*Variance analysis with unknowns*) ATTENTION Products manufactures a neon lamp sign with the following standard conversion costs:

Direct labor (4 hours @ \$12 per hour)	\$ 48
Factory overhead (10,000 DLH expected capacity)	
Variable (4 hours @ \$16 per hour)	64
Fixed (4 hours @ \$8 per hour)	32
Total unit conversion cost	<u>\$144</u>

The following data are given for December, when 8,000 standard labor hours were used:

Labor rate variance	\$ 4,500 U
Labor efficiency variance	12,000 U
Actual variable overhead	153,000
Actual fixed overhead	78,000

Calculate the answers for the following unknowns:

- a. Total applied factory overhead
- b. Volume variance
- c. Variable overhead spending variance
- d. Variable overhead efficiency variance
- e. Total actual overhead
- f. Number of units manufactured

51. (*Combined overhead rates*) Rocky Mountain Industries manufactures a down-filled sleeping bag with the following standard cost information for 2001:

- Each sleeping bag requires 1 hour of machine time to produce.
- Variable overhead: \$9 per machine hour
- Fixed overhead: \$12 per machine hour; calculated as total budgeted overhead divided by expected annual capacity of 30,000 machine hours

Production Statistics for 2001:

Number of sleeping bags produced	31,000 units
Actual machine hours	33,300 hours
Variable overhead cost incurred	\$266,400
Fixed overhead cost incurred	\$353,500

- a. Using a combined overhead rate, calculate variances according to the two-variance approach.
- b. Using a combined overhead rate, calculate variances according to the three-variance approach.

52. (*Comprehensive*) Aluma Corporation manufactures metal screen doors for commercial buildings. The standard costs per screen door follow:

Direct Materials:

Aluminum	4 sheets at \$2	\$ 8
Copper	3 sheets at \$4	12
Direct labor	7 hours at \$8	56
Variable overhead	5 machine hours at \$3	15
Fixed overhead	5 machine hours at \$2	10

Overhead rates were based on normal monthly capacity of 6,000 machine hours.

During November, 850 doors were produced. This was below normal levels due to the effects of a labor strike that occurred during union contract negotiations. Once the dispute was settled, the company scheduled overtime to try to catch up to regular production levels. The following costs were incurred in November:

Material:

Aluminum:	4,000 sheets purchased at \$2; used 3,500 sheets
Copper:	3,000 sheets purchased at \$4.20; used 2,600 sheets

Direct Labor:

Regular time:	5,200 hours at \$8.00 (precontract settlement)
Regular time:	900 hours at \$8.50 (postcontract settlement)

Variable Overhead:

\$11,700 (based on 4,175 machine hours)

Fixed Overhead:

\$9,300 (based on 4,175 machine hours)

Determine the following:

- a. Total material price variance
- b. Total material usage (quantity) variance
- c. Labor rate variance
- d. Labor efficiency variance
- e. Variable overhead spending variance
- f. Variable overhead efficiency variance
- g. Fixed overhead spending variance
- h. Volume variance
- i. Budget variance

53. (*Comprehensive; all variances; all methods*) Rainbow Painting Services Inc. paints interiors of residences and commercial structures. The firm's management has established cost standards based on the amount of area to be painted.

Direct material (\$18 per gallon of paint): \$1.50 per 100 square feet
 Direct labor: \$2 per 100 square feet
 Variable overhead: \$0.60 per 100 square feet
 Fixed overhead (based on 600,000 square feet per month): \$1.25 per 100 square feet

Management has determined that 400 square feet can be painted by the average worker each hour. During May 2001, the company painted 600,000 square feet of wall and ceiling space. The following costs were incurred:

Direct material (450 gallons purchased and used)	\$ 8,550.00
Direct labor (1,475 hours)	12,242.50
Variable overhead	3,420.00
Fixed overhead	7,740.00

- a. Compute the direct material variances.
 - b. Compute the direct labor variances.
 - c. Use a four-variance approach to compute overhead variances.
 - d. Use a three-variance approach to compute overhead variances.
 - e. Use a two-variance approach to compute overhead variances.
 - f. Reconcile your answers for parts (c) through (e).
 - g. Discuss other cost drivers that could be used as a basis for measuring activity and computing variances for this company.
54. (*Variance disposition*) Ito Manufacturing had the following variances at year-end 2001:

Material price variance	\$23,400 U
Material quantity variance	24,900 F
Labor rate variance	5,250 F
Labor efficiency variance	36,900 U
Variable overhead spending variance	3,000 U
Variable overhead efficiency variance	1,800 F
Fixed overhead spending variance	6,600 F
Volume variance	16,800 U

In addition, the inventory and cost of goods sold account balances were as follows at year-end 2001:

Raw Material Inventory	\$ 338,793
Work in Process Inventory	914,277
Finished Goods Inventory	663,663
Cost of Goods Sold	2,724,267

- a. Assuming that all variances are insignificant, prepare the journal entry at December 31 to dispose of them.
 - b. After posting your entry in part (a), what is the balance in Cost of Goods Sold?
 - c. Assuming that all variances are significant, prepare the necessary journal entries at December 31 to dispose of them.
 - d. What will be the balance in each of the inventory accounts and cost of goods sold account?
55. (*Conversion cost variances*) Sanchez Mfg. budgeted \$1,080,000 of variable conversion costs and \$360,000 of fixed conversion costs for May 2001. When the budget was developed, Sanchez estimated 72,000 machine hours would be required to make 24,000 units of product. During May, 76,000 machine hours were worked and the firm incurred \$1,128,600 of variable conversion costs and \$374,000 of fixed conversion costs. Twenty-five thousand units were produced in May.
- a. Calculate the four conversion cost variances assuming separation of fixed and variable costs is maintained.
 - b. Calculate the three conversion cost variances assuming fixed and variable costs are combined.
56. (*Appendix*) Pablo's three-topping 18-inch frozen pizzas are produced by Quintella Food Industries in Los Angeles. The company uses a standard cost system. The three toppings (in addition to cheese) for each pizza are onions, olives, and mushrooms. To some extent, discretion may be used to determine the actual mix of these toppings. The company has two classes of labor, and discretion may be used to determine the mix of the labor inputs. The standard cost card for a pizza follows:

Onions: 3 ounces at \$0.10 per ounce
 Olives: 3 ounces at \$0.35 per ounce
 Mushrooms: 3 ounces at \$0.50 per ounce
 Labor category 1: 5 minutes at \$12 per hour
 Labor category 2: 6 minutes at \$8 per hour

During May 2001, Quintella produced 12,000 pizzas and used the following inputs:

Onions:	2,000 pounds
Olives:	3,000 pounds
Mushrooms:	2,000 pounds
Labor category 1:	1,300 hours
Labor category 2:	1,000 hours

During the month there were no deviations from standards on material prices or labor rates.

- a. Determine the material quantity, mix, and yield variances.
- b. Determine the labor efficiency, mix, and yield variances.
- c. Prepare the journal entries to record the above mix and yield variances.

57. (*Appendix*) Colson Products makes NOTAM, a new health food. For a 50-pound batch, the standard costs for materials and labor are as follows:

	Quantity	Unit Price	Total
Wheat	25 pounds	\$0.20 per pound	\$5.00
Barley	25 pounds	\$0.10 per pound	2.50
Corn	10 pounds	\$0.05 per pound	0.50
Skilled labor	0.8 hours	\$12.00 per hour	9.60
Unskilled labor	0.2 hours	\$ 8.00 per hour	1.60

During June, the following materials and labor were used in producing 600 batches of NOTAM:

Wheat	18,000 pounds at \$0.22 per pound
Barley	14,000 pounds at \$0.11 per pound
Corn	10,000 pounds at \$0.04 per pound
Skilled labor	400 hours at \$12.25 per hour
Unskilled labor	260 hours at \$8.00 per hour

- a. Calculate the material quantity, mix, and yield variances.
- b. Calculate the labor efficiency, mix, and yield variances.

CASES

58. (*Standards revision*) Westlake Company produces a component for aircraft manufacturers. A standard cost system has been used for years with good results. Unfortunately, Westlake's original direct material source went out of business. The new source produces a similar but higher quality material. The price per pound from the original source averaged \$7; the price from the new source is \$7.77. The new material reduces scrap and, thus, reduces the use of direct material from 1.25 to 1.00 pounds per unit. In addition, direct labor is reduced from 24 to 22 minutes per unit because there is less scrap labor and machine setup time.

The direct material problem was occurring at the same time that labor negotiations resulted in an increase of over 14 percent in hourly direct labor costs. The average rate rose from \$12.60 per hour to \$14.40 per hour. Production of the main product requires a high level of labor skill. Because of a continuing shortage in that skill area, an interim wage agreement had to be signed.

Westlake started using the new direct material on April 1, the same date that the new labor agreement went into effect. However, the company is still using standards that were set at the beginning of the calendar year. The direct material and direct labor standards for the component are as follows:

Direct material	1.2 pounds at \$6.80 per pound	\$ 8.16
Direct labor	20 minutes at \$12.30 per DLH	<u>4.10</u>
Standard cost per unit		<u>\$12.26</u>

Howard Foster, cost accounting supervisor, had been examining the following April 30 performance report.

PERFORMANCE REPORT STANDARD COST VARIANCE ANALYSIS FOR APRIL 2001						
Standard	Price Variance		Quantity Variance		Actual	
DM	\$ 8.16	(\$0.97 × 1.0) \$0.97 U	(\$6.80 × 0.2) \$1.36 F			\$ 7.77
DL	4.10	[\$2.10 × (22/60)] 0.77 U	[\$12.30 × (2/60)] 0.41 U			5.28
	<u>\$12.26</u>					<u>\$13.05</u>
COMPARISON OF 2001 ACTUAL COSTS						
	Average 1st Quarter Costs	April Costs		% Increase (Decrease)		
DM	\$ 8.75	\$ 7.77		(11.2)		
DL	5.04	5.28		4.8		
	<u>\$13.79</u>	<u>\$13.05</u>		(5.4)		

Jane Keene, assistant controller, came into Foster's office and Foster said, "Jane, look at this performance report! Direct material price increased 11 percent and the labor rate increased over 14 percent during April. I expected greater variances, yet prime costs decreased over 5 percent from the \$13.79 we experienced during the first quarter of this year. The proper message just isn't coming through."

"This has been an unusual period," said Keene. "With all the unforeseen changes, perhaps we should revise our standards based on current conditions and start over."

Foster replied, "I think we can retain the current standards but expand the variance analysis. We could calculate variances for the specific changes that have occurred to direct material and direct labor before we calculate the normal price and quantity variances. What I really think would be useful to management right now is to determine the impact the changes in direct material and direct labor had in reducing our prime costs per unit from \$13.79 in the first quarter to \$13.05 in April—a reduction of \$0.74."

- Discuss the advantages of (1) immediately revising the standards and (2) retaining the current standards and expanding the analysis of variances.
- Prepare an analysis that reflects the impact of the new direct material and new labor contract on reducing Westlake's prime costs per unit from \$13.79 to \$13.05. The analysis should show the changes in direct material and direct labor costs per unit that are caused by (1) the use of new direct materials and (2) the new labor contract. This analysis should be in sufficient detail to identify the changes due to direct material price, direct labor rate, the effect of direct material quality on direct material usage, and the effect of direct material quality on direct labor usage. *(CMA adapted)*

59. (*Variances and variance responsibility*) Hobby Horse, Inc., began operations in 2000. In 2001, the company manufactured only one product, a handpainted toy horse. The 2001 standard cost per unit is as follows:

Material: one pound plastic at \$2.00	\$ 2.00
Direct labor: 1.6 hours at \$4.00	6.40
Variable overhead cost	3.00
Fixed overhead cost	1.45
	<u>\$12.85</u>

The overhead cost per unit was calculated from the following annual overhead cost budget for 60,000 units.

Variable Overhead Cost:

Indirect labor—30,000 hours at \$4.00	\$120,000	
Supplies (oil)—60,000 gallons at \$0.50	30,000	
Allocated variable service department costs	<u>30,000</u>	
Total variable overhead cost		\$180,000

Fixed Overhead Cost:

Supervision	\$ 27,000	
Depreciation	45,000	
Other fixed costs	<u>15,000</u>	
Total fixed overhead cost		<u>87,000</u>
Total budgeted overhead cost at 60,000 units		<u>\$267,000</u>

Following are the charges to the manufacturing department for November, when 5,000 units were produced:

Material (5,300 pounds at \$2.00)	\$10,600
Direct labor (8,200 hours at \$4.10)	33,620
Indirect labor (2,400 hours at \$4.10)	9,840
Supplies (oil) (6,000 gallons at \$0.55)	3,300
Allocated variable service department costs	3,200
Supervision	2,475
Depreciation	3,750
Other fixed costs	<u>1,250</u>
Total	<u>\$68,035</u>

The Purchasing Department normally buys about the same quantity as is used in production during a month. In November, 5,200 pounds of material were purchased at a price of \$2.10 per pound.

- a. Calculate the following variances from standard costs for the data given:
 1. Material purchase price
 2. Material quantity
 3. Direct labor rate
 4. Direct labor efficiency
 5. Overhead budget
- b. The company has divided its responsibilities so that the Purchasing Department is responsible for the price at which materials and supplies are purchased. The Manufacturing Department is responsible for the quantities of materials used. Does this division of responsibilities solve the conflict between price and quantity variances? Explain your answer.
- c. Prepare a report detailing the overhead budget variance. The report, which will be given to the Manufacturing Department manager, should show only that part of the variance that is her responsibility and should highlight the information in ways that would be useful to her in evaluating departmental performance and when considering corrective action.
- d. Assume that the departmental manager performs the timekeeping function for this manufacturing department. From time to time, analyses of overhead and direct labor variances have shown that the manager has deliberately misclassified labor hours (i.e., listed direct labor hours as indirect labor hours and vice versa) so that only one of the two labor variances is unfavorable. It is not feasible economically to hire a separate timekeeper. What should the company do, if anything, to resolve this problem?

(CMA adapted)

REALITY CHECK

60. In the mid-1940s, a young man named Donald Roy was working on a Ph.D. at the University of Chicago. As part of his dissertation project, Mr. Roy posed (anonymously) for eleven months as a radial-drill operator at a steel-processing plant. Workers in this plant were paid on a piece-rate basis (with a minimum hourly base pay of 85 cents) for all of the jobs (parts) they worked on. Some of the most interesting behaviors that Mr. Roy observed involved games the employees played based on their perceptions of the fairness of piece rates. If the employees perceived that the piece rates were set too low (required too much output per hour to exceed the base rate) they would engage in work slowdowns. Thus, they would receive the base rate pay of 85 cents per hour rather than the piece-rate pay. The company's cost of components produced when employees engaged in slowdowns was consequently higher than the piece-rate cost. The slowdown was essentially a way to express discontentment with the piece rate and implied to management a need to revise the piece-rate pay. Communication among employees ensured that, with respect to a certain part, all employees participated in the slowdown. Other jobs were recognized by employees as "gravy jobs." On these jobs, the piece rates were sufficiently high to allow employees to easily exceed the base rate pay without exerting significant effort. On these jobs, employees carefully monitored each other so that no employee generated income substantially above the base rate of 85 cents per hour. The fear was that managers would revise the piece rate if employees generated too much hourly income from the piece rate pay.

SOURCE: Donald Roy, "Quota Restriction and Goldbricking in a Machine Shop," *American Journal of Sociology* (March 1952), pp. 427–442. Published by the University of Chicago Press. Reprinted with permission.

- a. Why would it be difficult in the environment described by Donald Roy to develop credible standards of performance?
 - b. Was the behavior of the employees ethical?
 - c. Is it ethical for managers to revise piece-rate pay when it becomes obvious that standards can be easily met or beat?
 - d. How does honest communication between managers and workers help avoid the problems described by Donald Roy?
- 61.** Tim Zeff is a plant manager who has done a good job of controlling some overhead costs during the current period and a poor job of controlling others. Tim's boss has asked him for a variance report for the period.
- a. Discuss the ethics of using a two-variance approach to report the overhead variances rather than a three- or four-variance approach.
 - b. If Tim does not provide his boss with detailed information on the individual cost components and their related variances, can the boss judge Tim's performance during the period? Defend your answer.
- 62.** *In 1993, when nearly 9 million people couldn't find jobs, other Americans were putting in the most overtime since the government started keeping records in the 1950s. With factory workers averaging 4.2 hours of overtime per week, the Bureau of Labor Statistics said more than a tenth of all work done in the nation's factories was performed on overtime.*
- "If we could go back to the amount of overtime worked in 1982, we would create 3 million new jobs without increasing the federal deficit," said John Zalusky, an economist at the AFL-CIO. He said many workers are putting in extra hours against their wishes.*
- One reason employers were going the overtime route, economists said, was that overtime pay didn't cost much extra. Fringe benefits, representing as much as 40 percent of labor costs, were mostly covered by the first 40 hours worked.*

And the overtime hours generally were worked by employers' most skilled and productive people. Beyond that, using overtime avoided the cost of hiring and training new workers, finding space for them and dealing with the added paperwork. Because of all those factors, Zalusky calculated that paying a skilled worker time-and-a-half actually cost employers only about 3 percent extra.

SOURCE: Mike Feinsliber, "Employers Paying Overtime Instead of Hiring," (*New Orleans Times-Picayune* (March 18, 1993), p. C-2. © The Times-Picayune Publishing Corporation.

- a. How does overtime pay affect direct labor cost? Variable overhead?
 - b. Obviously, paying overtime to already employed workers makes better financial business sense than does hiring additional workers. If, however, workers would prefer not to work overtime but do so to maintain their jobs, how does overtime affect the ethical contract between employers and employees?
 - c. What effects might overtime have on job efficiency? On job effectiveness (such as quality of production)?
 - d. Would you be in favor of limiting allowable hours of overtime to have more individuals employed? Discuss this question from the standpoint of the government, the employer, a currently employed worker, and an unemployed individual.
- 63.** As of 1983, Medicare began reimbursing hospitals according to diagnostic related groups (DRGs). Each DRG has a specified standard length of stay. If a patient leaves the hospital early, the hospital is favorably financially impacted, but a patient staying longer than the specified time costs the hospital money.
- a. From the hospital administrator's point of view, would you want favorable "length of stay" variances? How might you go about trying to obtain such variances?
 - b. From a patient's point of view, would you want favorable "length of stay" variances? Answer this question from the point of view of a patient who has had minor surgery and from the point of view of a patient who has had major surgery.
 - c. Would favorable "length of stay" variances necessarily equate to high-quality care?
- 64.** *National standards for U.S. schools covering 13 subjects have been devised by educators in the arts, mathematics, history, English and the sciences. . . . Academic professional groups, meanwhile, have been so wary of offending minorities, and so protective of teachers' academic freedoms, that they have often come up with guidelines that are awash in generalities and impossible to codify into a curriculum.*
- An analysis in 1995 by the American Federation of Teachers found that only 13 states had developed standards clear enough to be translated into actual classroom curriculum. The others had standards that "were too vague for teachers to use them, for parents to understand them," said AFT president Albert Shanker.*
- The report also found that only seven states planned to require students to meet the standards to graduate. "In most states, students wouldn't in any way be affected by whether or not they can meet the standards," the report said.*
- The AFT found that most states developed their standards without reviewing what high-achieving countries such as Japan, Germany and France require of students. According to the AFT, at least a quarter of all secondary-school students in Germany, France, England and Japan passed at least one advanced exam in mathematics, science or other subjects. In the U.S., only 5% of students passed one of the advanced-placement exams that could have given them college credit; but the exams weren't required, and there was no penalty for failure.*

SOURCE: Gary Putka and Steve Stecklow, " 'A' for Effort: Educators Try to Set Standards—Again," *The Wall Street Journal* (March 26, 1996), p. B1. Reprinted by permission of *The Wall Street Journal*, © 1996 Dow Jones & Company, Inc. All Rights Reserved Worldwide. Permission conveyed through the Copyright Clearance Center.

- a. Research the education standards in your home state or country and prepare a report on them. Do you think these standards are measurable? Why or why not?
- b. Why do standards, regardless of the purpose for which they are set, need to be tied to consequences?
- c. Assume you have been elected state governor on an education reform platform. The state has in place some objective and measurable education standards. How would you tie these standards to consequences? What costs to the state's taxpayers would be associated with such consequences?
- d. Consider the following: Scott Paper spent \$400,000 screening 14,176 job applicants to hire 174. Of the 10,000 people who passed the initial screening, 4,000 failed a standardized English and high school algebra test. SOURCE: Raju Narisetti, "Manufacturers Decry a Shortage of Workers While Rejecting Many," *The Wall Street Journal* (September 8, 1995), p. A4. Scott was looking for employees to perform numerous tasks previously handled by managers, and the jobs had a starting salary of \$29,000. Do you think that educational standards would help a company like Scott Paper find qualified employees? Explain.

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