

## Chapter 10

### How Do Managers Evaluate Performance Using Cost Variance Analysis?

Jerry Feltz, president and owner of Jerry's Ice Cream, is discussing the results of operations for the year with the company's management group: Tom, the sales manager; Lynn, the production manager; and Michelle, the treasurer and controller.

Jerry:	<i>Good work, everyone! It looks as if our sales this past year exceeded the budget! We were expecting to sell 200,000 gallons of ice cream, but it turns out we sold 210,000 gallons. Credit goes to our sales staff for their hard work!</i>
Tom:	<i>Thanks, Jerry. We have a great group of salespeople and a terrific product.</i>
Jerry:	<i>I agree. I am concerned, however, about our direct labor and direct materials costs. We expected a 5 percent increase in these costs over the original budget since sales were 5 percent higher than anticipated. However, our cost overruns far exceeded the 5 percent increase. We've got to get a handle on both of these costs.</i>
Lynn:	<i>This doesn't sound right. My production crew used fewer materials than was budgeted, and the average time it took to make each unit was also less than expected. This should cause materials and labor costs to be lower than expected, not higher.</i>
Jerry:	<i>Michelle, are you sure we have the right information here?</i>
Michelle:	<i>Absolutely. Total costs for direct labor and direct materials were higher than budgeted, even after considering the increase in sales.</i>
Jerry:	<i>Can you give me more detail as to how this happened? I want to know what caused the increase in costs and how to prevent this from taking place in the future.</i>
Michelle:	<i>Can I have a week to pull the information together?</i>



Jerry:	You've got it.
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Jerry is evaluating the performance of his company by comparing actual costs to budgeted costs. This is the *control* phase of budgeting. We covered the *planning* phase of budgeting in [Chapter 9 "How Are Operating Budgets Created?"](#) by showing how Jerry's Ice Cream prepared a master budget. The focus of this chapter is on the control phase and how to calculate and analyze cost variances.

## 10.1 Flexible Budgets

### LEARNING OBJECTIVE

1. Understand how flexible budgets are used to evaluate performance.

*Question: The master budget in Chapter 9 "How Are Operating Budgets Created?" was prepared for only one level of activity (activity was measured by the number of units sold, which was budgeted at 200,000 units). Although this works well in the planning phase of budgeting, it is not appropriate for the control phase. Actual sales rarely match budgeted sales. When actual sales differ from budgeted sales, it is inappropriate and perhaps unfair to evaluate employee performance by comparing actual results to the master budget. If actual sales volume is higher than the master budget, variable costs should be higher than the master budget. The opposite is true as well. How do organizations modify the master budget to adjust for actual sales?*

Answer: Organizations use a modified budget called a flexible budget. A flexible budget is simply a revised master budget based on the actual activity level. It represents what costs should be given a certain level of activity. The master budget at Jerry's Ice Cream was based on sales of 200,000 units and production of 200,400 units. Because actual sales totaled 210,000 units, the flexible budget should be based on 210,000 units of activity. (It should be noted that in Chapter 9 "How Are Operating Budgets Created?", we presented an example with budgeted sales of 200,000 units and budgeted production of 200,400 units resulting from differing beginning and ending finished goods inventory amounts. In this chapter, we assume beginning and ending finished goods inventory are the same, and therefore units produced and sold will be the same. Thus we assume actual sales and actual production total 210,000 units.)



*Question: Imagine being the production manager at Jerry's Ice Cream, and you are evaluated based on the quantity of direct materials used in production. Would it be fair to compare the materials used to produce 210,000 units with the master budget showing the materials that should have been used to produce 200,400 units?*

Answer: Probably not. The budget should be adjusted upward to reflect the actual number of units produced before a comparison is made, thus the term flexible budget. As we develop the process of cost variance analysis, we will use flexible budget information. That is, we will revise the master budget for direct materials, direct labor, and variable manufacturing overhead to reflect actual sales volume of 210,000 units. However, we must first describe the concept of standard cost.

#### KEY TAKEAWAY

- A flexible budget is a revised master budget that represents expected costs given actual sales. Costs in the flexible budget are compared to actual costs to evaluate performance.

#### REVIEW PROBLEM 10.1

What is a flexible budget, and why do companies use a flexible budget to evaluate production managers?

Solution to Review Problem 10.1

A flexible budget is a revised master budget based on the actual activity level achieved for a period. The master budget is established before the period begins for planning purposes, and the flexible budget is established after the period ends for control and evaluation purposes. Production managers are evaluated using the flexible budget because the usage of direct materials, direct labor, and manufacturing overhead will depend on the actual number of units produced.



## 10.2 Standard Costs

### LEARNING OBJECTIVE

1. Explain how standard costs are established.

*Question: Companies often use standard costs for planning and control purposes. What are standard costs?*

Answer: Standard costs are costs that management expects to incur to provide a good or service. They serve as the “standard” by which performance will be evaluated. For example, fast-food restaurants have a standard for the length of time it should take to serve a drive-through-window customer. Phone directory operators have a standard length of time it should take to provide a phone number to a customer. Manufacturing companies have a standard quantity of direct materials to be used to produce one unit of product.

### The Difference between Standard Costs and Budgeted Costs

*Question: What is the difference between standard costs and budgeted costs?*

Answer: The term standard cost refers to a specific cost per unit. Budgeted cost refers to costs in total given a certain level of activity. Standard variable production costs at Jerry’s Ice Cream are shown in .

Figure 10.1 Standard Costs at Jerry’s Ice Cream

	<b>Standard Cost Per Unit</b>
Direct materials (2 pounds per unit at \$1 per pound)*	\$2.00
Direct labor (0.10 hours at \$13 per hour)**	1.30
Variable overhead (0.10 direct labor hours** at \$5 per hour)†	0.50
Standard variable production cost per unit	<u>\$3.80</u>

\*Direct materials standards come from the direct materials purchases budget presented in .



\*\*Direct labor standards come from the direct labor budget presented in .

† Variable overhead costs are applied to products based on direct labor hours. Variable overhead cost per direct labor hour is calculated by dividing total variable overhead costs of \$100,200 (from the manufacturing overhead budget in ) by 20,040 total direct labor hours (from the direct labor budget in ), which results in a standard variable overhead rate of \$5 per direct labor hour.

These standard costs can then be used to establish a flexible budget based on a given level of activity. For example, let's use Jerry's actual sales of 210,000 units. The variable production costs expected to produce these units are shown in the flexible budget in .

Figure 10.2 Flexible Budget for Variable Production Costs at Jerry's Ice Cream

	<b>Flexible Budget at 210,000 Units</b>
Direct materials (\$2.00 per unit × 210,000 units)	\$420,000
Direct labor (\$1.30 per unit × 210,000 units)	273,000
Variable overhead (\$0.50 per unit × 210,000 units)	105,000
Total budgeted variable production costs at 210,000 units	<u>\$798,000</u>

The standard cost presented in shows the variable production costs expected to produce one unit. The flexible budget in uses the standard cost information to show the variable production costs expected in total given a certain level of activity (210,000 units in this example). Later in the chapter, we compare the flexible budget presented in to actual results and analyze the difference. The flexible budget graph presented in shows that direct materials have the highest variable production cost at \$420,000, followed by direct labor at \$273,000 and variable overhead at \$105,000.

Figure 10.3 Flexible Budget



### Establishing Standard Cost

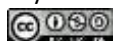
*Question: What are the components needed to establish a standard cost for direct materials, direct labor, and variable manufacturing overhead?*

Answer: Notice in that direct materials has two separate standards necessary to calculate the standard cost: standard quantity to produce 1 unit of product (2 pounds) and standard price (\$1 per pound). Direct labor has two separate standards as well: standard hours to produce 1 unit of product (0.10 hours) and standard rate (\$13 per hour). Variable manufacturing overhead also has 2 separate standards: standard hours to produce 1 unit of product (0.10 direct labor hours) and standard rate (\$5 per hour). Thus there are two separate standards necessary to establish each standard cost or six standards in total to establish a standard cost for direct materials, direct labor, and variable manufacturing overhead.

As we explain next, there are many approaches to establishing these six standards for direct materials, direct labor, and variable manufacturing overhead (we discuss fixed manufacturing overhead at the end of this chapter).

### Direct Materials Standard Quantity and Standard Price

*Question: How do organizations determine the standard quantity and standard price for direct materials?*



Answer: The standard quantity for direct materials represents the materials required to complete one good unit of product (i.e., a product with no defects), and it includes an allowance for waste and spoilage. For Jerry's Ice Cream, the standard quantity of materials needed for each gallon of product is given in the recipe. Jerry's adds a certain amount to the recipe quantity for waste and spoilage. Similar to this approach, companies might find the standard quantity in the product specifications outlined by product engineers. Some companies review historical production information to determine quantities used in the past and use this information to set standard quantities for the future.

The standard price for direct materials represents the final delivered cost of the materials and includes items such as shipping and insurance. The standard price for materials at Jerry's comes from the purchase contract negotiated with the company's supplier. As an alternative to this approach, companies might use historical data or look at price trends in the marketplace.

As shown in , for Jerry's Ice Cream, the standard quantity of direct materials is 2 pounds per unit, and the standard price is \$1 per pound. Thus the standard cost per unit for direct materials is \$2, calculated as follows:

$\$2 \text{ standard cost per unit} = 2 \text{ pounds per unit} \times \$1 \text{ per pound}$

### **Direct Labor Standard Hours and Standard Rate**

*Question: How do organizations determine the standard hours and standard rate for direct labor?*

Answer: The standard hours for direct labor represents the direct labor time required to complete one good unit of product and includes an allowance for breaks and production inefficiencies such as machine downtime. Jerry's Ice Cream established this standard using historical information. In addition to this approach, companies might use time and motion studies performed by engineers who observe production workers and analyze the time required to perform production activities.

The standard rate for direct labor represents the average cost of wages and benefits for each hour of direct labor work performed. Jerry's Ice Cream looked at past payroll records to determine



this standard. Companies also review labor contracts to estimate the costs associated with direct labor.

As shown in , for Jerry’s Ice Cream, the standard hours for direct labor is 0.10, and the standard rate is \$13 per hour. Thus the standard cost per unit for direct labor is \$1.30, calculated as follows:

$$\$1.30 \text{ standard cost per unit} = 0.10 \text{ direct labor hours per unit} \times \$13 \text{ per hour}$$

### **Variable Manufacturing Overhead Standard Quantity and Standard Rate**

*Question: How do organizations determine the standard quantity and standard rate for variable manufacturing overhead?*

Answer: The standard quantity for variable manufacturing overhead represents the time required to complete one unit of product. This time is often measured in direct labor hours or machine hours, depending on how the company chooses to allocate overhead (recall that we covered the choice of allocation base at length in ). Jerry’s Ice Cream uses direct labor hours to allocate variable manufacturing overhead, so we apply the same standard quantity used for direct labor.

The standard rate for variable manufacturing overhead represents the variable portion of the predetermined overhead rate used to allocate overhead costs to products (see for further discussion of predetermined overhead rates).

As shown in , for Jerry’s Ice Cream, the standard quantity of direct labor hours is 0.10, and the standard rate (predetermined overhead rate) is \$5 per direct labor hour. Thus the standard cost per unit for variable manufacturing overhead is \$0.50, calculated as follows:

$$\$0.50 \text{ standard cost per unit} = 0.10 \text{ direct labor hours per unit} \times \$5 \text{ per hour}$$

### **Ideal Standards and Attainable Standards**

*Question: In the process of establishing standards, managers must decide between using ideal standards or attainable standards. What is the difference between these two standards?*





Answer: Ideal standards are set assuming production conditions are perfect. For example, ideal standards assume machines never break down, employees are never ill, and materials are never wasted. Although ideal standards may provide motivation for workers to strive for excellence, these standards can also have a negative impact because they may be impossible to achieve.

As an alternative to ideal standards, most managers use attainable standards. Attainable standards take into consideration the likelihood of encountering problems in production such as machine downtime, electricity outages, materials waste, and employee illnesses. Most managers feel attainable standards have a positive behavioral impact on workers because the standards are reasonable and attainable under normal production conditions. We assume the use of attainable standards throughout this chapter.

### **Controlling Operations through Standards**

*Question: How are standards used to control operations?*

Answer: Companies typically use standards to analyze the difference between budgeted costs and actual costs. The process of analyzing differences between standard costs and actual costs is called variance analysis. Managerial accountants perform variance analysis for costs including direct materials, direct labor, and manufacturing overhead.

Standard costs are also used to determine product costs. Companies using standard costing systems are able to estimate product costs without having to wait for actual product cost data, and they often record transactions using standard cost information. The appendix shows how this process works using journal entries.





*Source: Photo courtesy of Keith*

*Allison, <http://www.flickr.com/photos/keithallison/2310444991/>.*

**Controlling Costs in the NBA**

The **National Basketball Association (NBA)** imposes a “salary cap” that dictates a maximum dollar amount each team can pay its players collectively in one season. The salary cap is based on a percentage of basketball-related income and was set at \$57,700,000 per team for the 2009–10 season. This serves as the cost budget for player payroll. However, “salary exceptions” allow many teams to exceed the salary cap. Annual salaries for some of the highest paid players for the 2009–10 season are shown as follows:

- Kevin Garnett, Boston: \$24,800,000
- Jason Kidd, Dallas: \$21,400,000
- Kobe Bryant, Los Angeles: \$21,300,000
- Shaquille O’Neal, Phoenix: \$21,000,000
- Tim Duncan, San Antonio: \$20,600,000
- Ray Allen, Boston: \$18,400,000

Imagine being the manager of the Boston Celtics and having to pay one player almost half of your entire budget! Clearly, controlling costs in this type of business environment is a challenge, and budgeting is a crucial element in achieving financial success.

Source: InsideHoops.com, “Home Page,” <http://www.insidehoops.com>.

#### KEY TAKEAWAY

- Standard costs are costs management expects to incur to provide a good or service. Manufacturing companies often establish standard costs for direct labor, direct materials, and manufacturing overhead. Standard cost information comes from a number of sources such as historical data, product specifications outlined by product engineers, contracts with suppliers, and labor union contracts.

#### REVIEW PROBLEM 10.2

Recall from the review problems in that Carol’s Cookies produces cookies for resale at grocery stores throughout North America. We established a master budget indicating Carol expects to use 1.5 pounds of direct materials for each unit produced at a cost of \$2 per pound (1 unit = 1 batch of cookies). Each unit produced will require 0.20 direct labor hours at a cost of \$12 per hour. Variable manufacturing overhead is applied



based on direct labor hours at a rate of \$3.50 per hour. Last year's sales were expected to total 400,000 units.

Carol just received last year's actual results showing sales of 390,000 units.

1. Calculate the standard cost per unit for direct materials, direct labor, and variable manufacturing overhead using the format shown in .
2. Prepare a flexible budget based on actual sales for direct materials, direct labor, and variable manufacturing overhead using the format shown in .

### Solution to Review Problem 10.2

1.

	<b>Standard Cost per Unit</b>
Direct materials (1.5 pounds per unit at \$2.00 per pound)	\$3.00
Direct labor (0.20 hours at \$12.00 per hour)	2.40
Variable overhead (0.20 direct labor hours at \$3.50 per hour)	0.70
<b>Standard variable production cost per unit</b>	<b><u>\$6.10</u></b>

2.

	<b>Flexible Budget at 390,000 Units</b>
Direct materials (\$3.00 per unit × 390,000 units)	\$1,170,000
Direct labor (\$2.40 per unit × 390,000 units)	936,000
Variable overhead (\$0.70 per unit × 390,000 units)	273,000
<b>Total budgeted variable production costs at 390,000 units</b>	<b><u>\$2,379,000</u></b>

### 10.3 Direct Materials Variance Analysis

## LEARNING OBJECTIVE

### 1. Calculate and analyze direct materials variances.

*Question: In the dialogue at the beginning of the chapter, the president of Jerry's Ice Cream was concerned about significant cost overruns for direct materials. We cannot simply explain these costs by saying that "we paid too much for materials" or "too many materials were used in production." Variances must be calculated to identify the exact cause of the cost overrun. What variances are used to analyze the difference between actual direct material costs and standard direct material costs?*

Answer: The difference between actual costs and standard (or budgeted) costs is typically explained by two separate variances: the materials price variance and materials quantity variance. The materials price variance is the difference between actual costs for materials purchased and budgeted costs based on the standards.

The materials quantity variance is the difference between the actual quantity of materials used in production and budgeted materials that should have been used in production based on the standards.

To this point, we have provided the data for Jerry's Ice Cream necessary to calculate standard costs. However, you must also have the actual materials cost and materials quantity data to calculate the variances described previously. The actual data for the year are as follows:

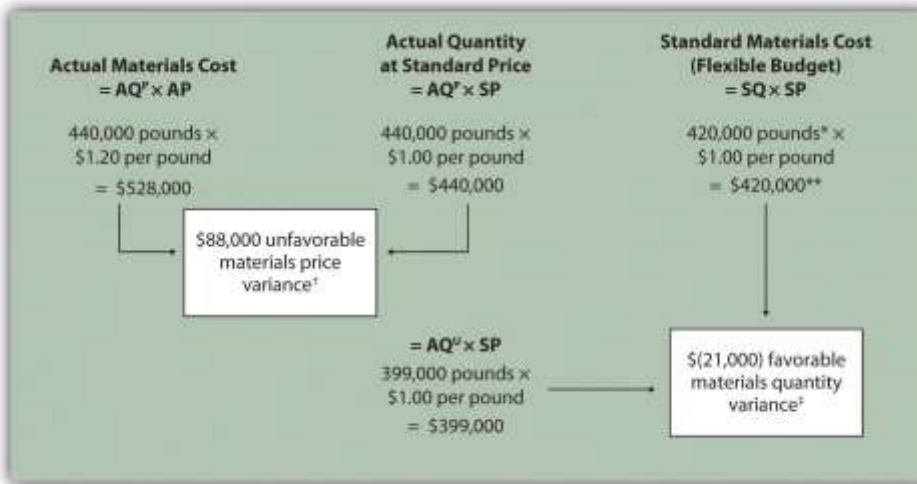
Sales volume	210,000 units
Direct materials purchased	440,000 pounds
Cost of direct materials purchased	\$1.20 per pound
Direct materials used in production	399,000 pounds

Recall from that the direct materials standard price for Jerry's is \$1 per pound, and the standard quantity of direct materials is 2 pounds per unit. shows how to calculate the materials price and



quantity variances given the actual results and standards information. Review this figure carefully before moving on to the next section where these calculations are explained in detail.

Figure 10.4 Direct Materials Variance Analysis for Jerry's Ice Cream



Note: AQP = Actual quantity of materials purchased. AP = Actual price of materials. AQU = Actual quantity of materials used in production. SP = Standard price of materials. SQ = Standard quantity of materials for actual level of activity.

\*Standard quantity of 420,000 pounds = Standard of 2 pounds per unit × 210,000 actual units produced and sold.

\*\*\$420,000 standard direct materials cost matches the flexible budget presented in .

† \$88,000 unfavorable materials price variance = \$528,000 – \$440,000. Variance is unfavorable because the actual price of \$1.20 is higher than the expected (budgeted) price of \$1.

‡ \$(21,000) favorable materials quantity variance = \$399,000 – \$420,000. Variance is favorable because the actual quantity of materials used in production of 399,000 pounds is lower than the expected (budgeted) quantity of 420,000 pounds.

## Direct Materials Price Variance Calculation

*Question: The materials price variance answers the question, did we spend more or less on direct materials than expected? If the variance is unfavorable, we spent more than expected. If the variance is favorable, we spent less than expected. How is the materials price variance calculated?*

Answer: As shown in , the materials price variance is the difference between the actual quantity of materials purchased at the actual price and the actual quantity of materials purchased at the standard price:

### Key Equation

$$\text{Materials price variance} = (AQ^P \times AP) - (AQ^P \times SP)$$

Materials price variance =  $(AQ^P \times AP) - (AQ^P \times SP) = (440,000 \times \$1.20) - (440,000 \times \$1.00) = \$88,000$  unfavorable

Alternative Calculation. Since we are holding the actual quantity constant and evaluating the difference between actual price and standard price, the materials price variance calculation can be simplified as follows:

### Key Equation

$$\text{Materials price variance} = (AP - SP) \times AQ^P$$

Materials price variance =  $(AP - SP) \times AQ^P = (\$1.20 - \$1.00) \times 440,000 = \$88,000$  unfavorable

Note that both approaches—the direct materials price variance calculation and the alternative calculation—yield the same result.

When labeling the variances calculated in this chapter, notice that all positive variances are unfavorable and all negative variances are favorable (i.e., unfavorable cost variances *increase* expected costs and favorable cost variances *decrease* expected costs). As you calculate variances, you should think through the variance to confirm whether it is favorable or unfavorable. For example, the materials price variance calculation



presented previously shows the actual price paid for materials was \$1.20 per pound and the standard price was \$1. Clearly, this is unfavorable because the actual price was higher than the expected (budgeted) price.

### Direct Materials Quantity Variance Calculation

*Question: The materials quantity variance answers the question, did we use more or fewer direct materials in production than expected? If the variance is unfavorable, we used more than expected. If the variance is favorable, we used fewer than expected. How is the materials quantity variance calculated?*

Answer: As shown in , the materials quantity variance is the difference between the actual quantity of materials used in production at the standard price and the standard quantity of materials allowed at the standard price:

#### Key Equation

$$\text{Materials quantity variance} = (\text{AQ}^{\text{U}} \times \text{SP}) - (\text{SQ} \times \text{SP})$$

$$\text{Materials quantity variance} = (\text{AQ}^{\text{U}} \times \text{SP}) - (\text{SQ} \times \text{SP}) = (399,000 \times \$1.00) - (420,000 \times \$1.00) = (\$21,000) \text{ favorable}$$

The standard quantity of 420,000 pounds is the quantity of materials allowed given actual production. For Jerry's Ice Cream, the standard quantity of materials per unit of production is 2 pounds per unit. Thus the standard quantity (SQ) of 420,000 pounds is 2 pounds per unit  $\times$  210,000 units produced and sold.

Alternative Calculation. Since we are holding the standard price constant and evaluating the difference between actual quantity used and standard quantity, the materials quantity variance calculation can be simplified as follows:

#### Key Equation

$$\text{Materials quantity variance} = (\text{AQ}^{\text{U}} - \text{SQ}) \times \text{SP}$$

$$\text{Materials quantity variance} = (\text{AQ}^{\text{U}} - \text{SQ}) \times \text{SP} = (399,000 - 420,000) \times \$1.00 = (\$21,000) \text{ favorable}$$





Note that both approaches—the direct materials quantity variance calculation and the alternative calculation—yield the same result.

The materials quantity variance calculation presented previously shows the actual quantity used in production of 399,000 pounds is lower than the expected (budgeted) quantity of 420,000 pounds. Clearly, this is *favorable* because the actual quantity used was lower than the expected (budgeted) quantity.

### Possible Causes of Direct Materials Variances

*Question: The managerial accountant at Jerry’s Ice Cream will likely investigate the cause of the unfavorable materials price variance of \$88,000. This will lead to discussions with the purchasing department. What might have caused the \$88,000 unfavorable materials price variance?*

Answer: The left panel of contains some possible explanations for this variance.

Figure 10.5 Possible Causes of Direct Materials Variances for Jerry’s Ice Cream

Unfavorable Materials Price Variance	Favorable Materials Quantity Variance
<ul style="list-style-type: none"><li>• High demand for materials caused a supplier to raise prices.</li><li>• The shutdown of a key supplier caused materials shortages and higher prices.</li><li>• The purchasing agent was ineffective in negotiating the lowest price.</li><li>• Higher-quality materials were purchased at a higher price.</li></ul>	<ul style="list-style-type: none"><li>• Higher-quality materials reduced waste and spoilage.</li><li>• An employee training program improved the efficient use of materials.</li><li>• New production techniques promoted more efficient use of materials.</li><li>• Improved maintenance of production equipment reduced waste of materials.</li></ul>

Whatever the cause of this unfavorable variance, Jerry’s Ice Cream will likely take action to improve the cost problem identified in the materials price variance analysis. This is why we use the term control phase of budgeting to describe variance analysis. Through variance analysis,



companies are able to identify problem areas (material costs for Jerry's) and consider alternatives to controlling costs in the future.

*Question: Jerry's Ice Cream might also choose to investigate the \$21,000 favorable materials quantity variance. Although this could be viewed as good news for the company, management may want to know why this favorable variance occurred. What might have caused the \$21,000 favorable materials quantity variance?*

Answer: The right panel of contains some possible explanations for this variance.

Notice how the cause of one variance might influence another variance. For example, the unfavorable price variance at Jerry's Ice Cream might have been a result of purchasing high-quality materials, which in turn led to less waste in production and a favorable quantity variance. This also might have a positive impact on direct labor, as less time will be spent dealing with materials waste.

Illustrates just how important it is to track direct materials variances accurately.

#### Business in Action 10.2

##### The Effect of Rising Materials Costs on Auto Suppliers

In the first six months of 2004, steel prices increased 76 percent, from \$350 a ton to \$617 a ton. For auto suppliers that use hundreds of tons of steel each year, this had the unexpected effect of increasing expenses and reducing profits. For example, a major producer of automotive wheels had to reduce its annual earnings forecast by \$10,000,000 to \$15,000,000 as a result of the increase in steel prices.

Most auto part suppliers operate with very small margins. **GR Spring and Stamping, Inc.**, a supplier of stampings to automotive companies, was generating pretax profit margins of about 3 percent prior to the increase in steel prices. Profit margins have been cut in half since steel prices began rising.

These thin margins are the reason auto suppliers examine direct materials variances so carefully. Any unexpected increase in steel prices will likely cause significant unfavorable materials price variances, which will lead to lower profits. Auto part



suppliers that rely on steel will continue to scrutinize materials price variances and materials quantity variances to control costs, particularly in a period of rising steel prices.

Source: Brett Clanton, "Steel Costs Slam Auto Suppliers," *The Detroit News*, June 29, 2004, <http://www.detnews.com>.

### Clarification of Favorable Versus Unfavorable

*Question: Why are variances labeled favorable or unfavorable?*

Answer: The terms favorable and unfavorable relate to the impact the variance has on budgeted operating profit. A favorable variance has a positive impact on operating profit.

An unfavorable variance has a negative impact on operating profit. Companies using a standard cost system ultimately credit favorable variances and debit unfavorable variances to income statement accounts. The appendix to this chapter describes this process in further detail.

#### KEY TAKEAWAY

- Standard costs are used to establish the flexible budget for direct materials. The flexible budget is compared to actual costs, and the difference is shown in the form of two variances. The *materials price variance* focuses on the price paid for materials, and it is defined as the difference between the actual quantity of materials purchased at the actual price and the actual quantity of materials purchased at the standard price. The *materials quantity variance* focuses on the quantity of materials used in production. It is defined as the difference between the actual quantity of materials used in production and budgeted materials that should have been used in production based on the standards.

#### REVIEW PROBLEM 10.3

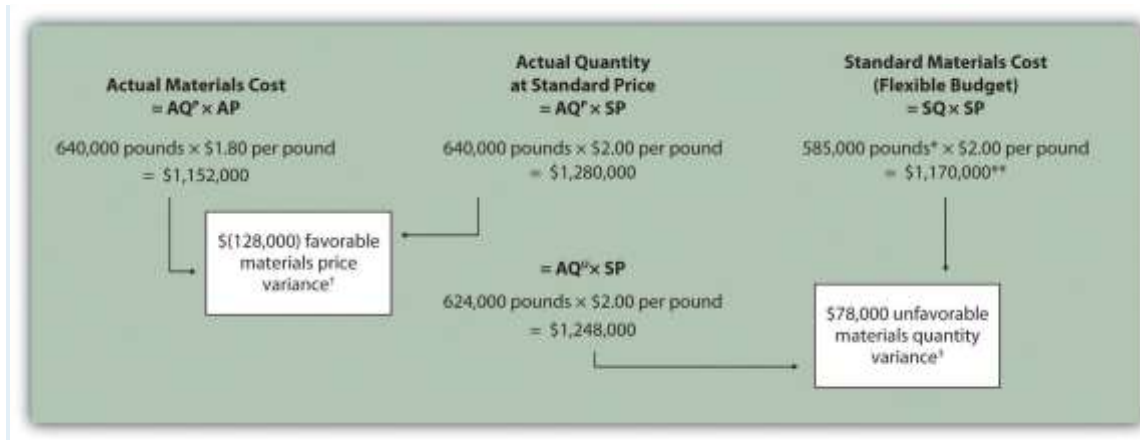
Carol's Cookies expected to use 1.5 pounds of direct materials to produce 1 unit (batch) of product at a cost of \$2 per pound. Actual results are in for last year, which indicates 390,000 batches of cookies were sold. The company purchased 640,000 pounds of materials at \$1.80 per pound and used 624,000 pounds in production.



1. Calculate the materials price and quantity variances using the format shown in .
2. Use the alternative approach to calculating the materials price and quantity variances, and compare the result to the result in part 1. (Hint: the variances should match.)
3. Suggest several possible reasons for the materials price and quantity variances.

### Solution to Review Problem 10.3

1. As shown in the following, the materials price variance is \$(128,000) favorable, and the materials quantity variance is \$78,000 unfavorable.



Note:  $AQ^P$  = Actual quantity of materials purchased.  $AP$  = Actual price of materials.  $AQ^U$  = Actual quantity of materials used in production.  $SP$  = Standard price of materials.  $SQ$  = Standard quantity of materials for actual level of activity.

\*Standard quantity of 585,000 pounds = Standard of 1.5 pounds per unit  $\times$  390,000 actual units produced and sold.

\*\*\$1,170,000 standard direct materials cost matches the flexible budget presented in , part 2.

<sup>†</sup>  $\$(128,000)$  favorable materials price variance =  $\$1,152,000 - \$1,280,000$ .

Variance is favorable because the actual price of \$1.80 is lower than the expected (budgeted) price of \$2

<sup>‡</sup>  $\$78,000$  unfavorable materials quantity variance =  $\$1,248,000 -$

$\$1,170,000$ . Variance is unfavorable because the actual quantity of materials used in production of 624,000 pounds is higher than the expected (budgeted) quantity of 585,000 pounds.

## 2. Alternative direct materials variance calculations:

Materials price variance =  $(AP - SP) \times AQP = (\$1.80 - \$2.00) \times 640,000 = \$(128,000)$  favorable (same as part 1)

Materials quantity variance =  $(AQU - SQ) \times SP = (624,000 - 585,000) \times \$2.00 = \$78,000$  unfavorable (same as part 1)

## 3. Possible causes of favorable materials price variance are

1. The supplier had excess materials on hand and lowered prices to sell off inventory;
2. New suppliers entered the market, which resulted in an excess supply of materials and lower prices;
3. Carol's Cookies' purchasing agent is a strong negotiator and was able to negotiate lower prices than anticipated;
4. Lower-quality materials were purchased at a lower price.

## Possible causes of unfavorable materials quantity variance are

1. Lower-quality materials resulted in more waste and spoilage;
2. New, inexperienced employees were hired, resulting in more waste;
3. Old equipment breaking down caused an increased amount of waste.

## 10.4 Direct Labor Variance Analysis



## LEARNING OBJECTIVE

### 1. Calculate and analyze direct labor variances.

*Question: In addition to investigating the causes of cost overruns for direct materials, the president of Jerry's Ice Cream wants to know why there were cost overruns for direct labor. What variances are used to analyze these types of direct labor cost overruns?*

Answer: Similar to direct materials variances, direct labor variance analysis involves two separate variances: the labor rate variance and labor efficiency variance.

The labor rate variance is the difference between actual costs for direct labor and budgeted costs based on the standards. The labor efficiency variance is the difference between the actual number of direct labor hours worked and budgeted direct labor hours that should have been worked based on the standards.

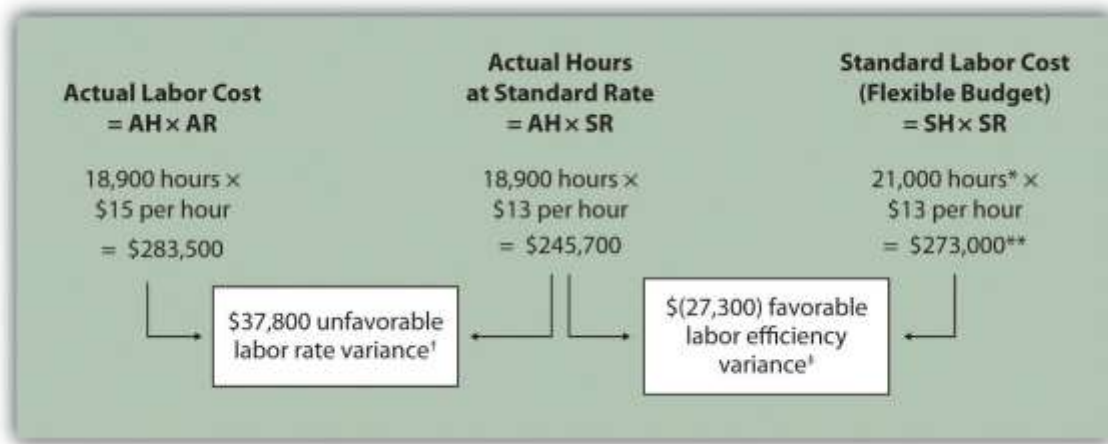
At Jerry's Ice Cream, the actual data for the year are as follows:

Sales volume	210,000 units
Direct labor hours worked	18,900 hours
Cost of direct labor	\$15 per hour

Recall from that the standard rate for Jerry's is \$13 per direct labor hour and the standard direct labor hours is 0.10 per unit. shows how to calculate the labor rate and efficiency variances given the actual results and standards information. Review this figure carefully before moving on to the next section where these calculations are explained in detail.

Figure 10.6 Direct Labor Variance Analysis for Jerry's Ice Cream





Note: AH = Actual hours of direct labor. AR = Actual rate incurred for direct labor. SR = Standard rate for direct labor. SH = Standard hours of direct labor for actual level of activity.

\*Standard hours of 21,000 = Standard of 0.10 hours per unit × 210,000 actual units produced and sold.

\*\*\$273,000 standard direct labor cost matches the flexible budget presented in .

† \$37,800 unfavorable labor rate variance = \$283,500 – \$245,700. Variance is unfavorable because the actual rate of \$15 is higher than the expected (budgeted) rate of \$13.

‡ \$(27,300) favorable labor efficiency variance = \$245,700 – \$273,000. Variance is favorable because the actual hours of 18,900 are lower than the expected (budgeted) hours of 21,000.

### Direct Labor Rate Variance Calculation

*Question: The direct labor rate variance answers the question, did we spend more or less on direct labor than expected? If the variance is unfavorable, we spent more than expected. If the variance is favorable, we spent less than expected. How is the labor rate variance calculated?*

Answer: As shown in , the labor rate variance is the difference between the actual hours worked at the actual rate and the actual hours worked at the standard rate:

### Key Equation

$$\text{Labor rate variance} = (\text{AH} \times \text{AR}) - (\text{AH} \times \text{SR})$$

$$\text{Labor rate variance} = (\text{AH} \times \text{AR}) - (\text{AH} \times \text{SR}) = (18,900 \times \$15) - (18,900 \times \$13) = \$37,800 \text{ unfavorable}$$

Alternative Calculation. Because we are holding the actual hours constant and evaluating the difference between actual rate and standard rate, the labor rate variance calculation can be simplified as follows:

### Key Equation

$$\text{Labor rate variance} = (\text{AR} - \text{SR}) \times \text{AH}$$

$$\text{Labor rate variance} = (\text{AR} - \text{SR}) \times \text{AH} = (\$15 - \$13) \times 18,900 = \$37,800 \text{ unfavorable}$$

Note that both approaches—direct labor rate variance calculation and the alternative calculation—yield the same result.

As with direct materials variances, all positive variances are unfavorable, and all negative variances are favorable. The labor rate variance calculation presented previously shows the actual rate paid for labor was \$15 per hour and the standard rate was \$13. This results in an unfavorable variance since the actual rate was higher than the expected (budgeted) rate.

## Direct Labor Efficiency Variance Calculation

*Question: The direct labor efficiency variance answers the question, did we use more or less direct labor hours in production than expected? If the variance is unfavorable, we used more than expected. If the variance is favorable, we used less than expected. How is the labor efficiency variance calculated?*

Answer: As shown in , the labor efficiency variance is the difference between the actual hours worked at the standard rate and the standard hours at the standard rate:





### Key Equation

$$\text{Labor efficiency variance} = (\text{AH} \times \text{SR}) - (\text{SH} \times \text{SR})$$

$$\text{Labor efficiency variance} = (\text{AH} \times \text{SR}) - (\text{SH} \times \text{SR}) = (18,900 \times \$13) - (21,000 \times \$13) = (\$27,300) \text{ favorable}$$

The 21,000 standard hours are the hours allowed given actual production. For Jerry's Ice Cream, the standard allows for 0.10 labor hours per unit of production. Thus the 21,000 standard hours (SH) is 0.10 hours per unit  $\times$  210,000 units produced.

Alternative Calculation. Because we are holding the standard rate constant and evaluating the difference between actual hours worked and standard hours, the labor efficiency variance calculation can be simplified as follows:

### Key Equation

$$\text{Labor efficiency variance} = (\text{AH} - \text{SH}) \times \text{SR}$$

$$\text{Labor efficiency variance} = (\text{AH} - \text{SH}) \times \text{SR} = (18,900 - 21,000) \times \$13 = (\$27,300) \text{ favorable}$$

Note that both approaches—the direct labor efficiency variance calculation and the alternative calculation—yield the same result.

The labor efficiency variance calculation presented previously shows that 18,900 in actual hours worked is lower than the 21,000 budgeted hours. Clearly, this is favorable since the actual hours worked was lower than the expected (budgeted) hours.

## Possible Causes of Direct Labor Variances

*Question: The managerial accountant at Jerry's Ice Cream is interested in finding the cause of the unfavorable labor rate variance of \$37,800. Jerry's Ice Cream might also choose to investigate the \$27,300 favorable labor efficiency variance. Although this could be viewed as good news for the company, management may want to know why this favorable variance occurred. What might have caused the \$37,800 unfavorable labor rate variance and \$27,300 favorable labor efficiency variance?*



Answer: contains some possible explanations for the labor rate variance (left panel) and labor efficiency variance (right panel).

Figure 10.7 Possible Causes of Direct Labor Variances for Jerry's Ice Cream

Unfavorable Labor Rate Variance	Favorable Labor Efficiency Variance
<ul style="list-style-type: none"><li>• Higher mix of skilled workers caused hourly rates to be higher than expected.</li><li>• An unexpected increase in demand caused the direct labor workforce to work overtime, requiring the company to pay overtime wages.</li><li>• A new labor contract increased wages for the direct labor workforce.</li></ul>	<ul style="list-style-type: none"><li>• A higher mix of skilled workers made more efficient use of labor hours.</li><li>• An employee training program improved the efficient use of time.</li><li>• New production techniques promoted more efficient use of time.</li><li>• High-quality materials resulted in less time spent working with materials waste.</li></ul>

As mentioned earlier, the cause of one variance might influence another variance. For example, many of the explanations shown in might also apply to the favorable materials quantity variance.

We have demonstrated how important it is for managers to be aware not only of the cost of labor, but also of the differences between budgeted labor costs and actual labor costs. This awareness helps managers make decisions that protect the financial health of their companies.

### Business in Action 10.3

#### Labor Costs in the Airline Industry

**United Airlines** asked a bankruptcy court to allow a one-time 4 percent pay cut for pilots, flight attendants, mechanics, flight controllers, and ticket agents. The pay cut was proposed to last as long as the company remained in bankruptcy and was expected to provide savings of approximately \$620,000,000. How would this unforeseen pay cut affect **United's** direct labor rate variance? The direct labor rate variance would likely be favorable, perhaps totaling close to \$620,000,000, depending on how much of these savings management anticipated when the budget was first established.

After filing for Chapter 11 bankruptcy in December 2002, **United** cut close to \$5,000,000,000 in annual expenditures. As a result of these cost cuts, United was able to emerge from bankruptcy in 2006.

Source: Associated Press, "United May Seek End to Union Contracts," *USA Today*, November 25, 2004.

#### Follow-Up Meeting at Jerry's Ice Cream

Jerry (president and owner), Tom (sales manager), Lynn (production manager), and Michelle (treasurer and controller) were at the meeting described at the opening of this chapter. Michelle was asked to find out why direct labor and direct materials costs were higher than budgeted, even after factoring in the 5 percent increase in sales over the initial budget. Lynn was surprised to learn that direct labor and direct materials costs were so high, particularly since actual materials used and actual direct labor hours worked were below budget.

The group met again a week later to discuss the issue.

<i>Jerry:</i>	<i>Michelle, what do you have for us?</i>
<i>Michelle:</i>	<i>My staff has been working hard to identify why direct materials and direct labor costs were higher than expected. First, I would like to confirm that these costs were indeed higher than anticipated.</i>



Lynn:	<i>I still don't see how this can be. My production crew was as efficient with their time and materials as they've ever been.</i>
Michelle:	<i>You're right, Lynn. Our variance analysis shows a favorable direct materials quantity variance, which relates directly to the amount of materials used, and a favorable direct labor efficiency variance, which relates directly to the efficiency of our production workers. Both variances are good news.</i>
Jerry:	<i>Then why are our direct labor and direct materials costs so high?</i>
Michelle:	<i>The answer relates directly to the price we paid for materials, and the hourly rates we paid for labor. Both were higher than expected. We expected to pay \$1 per pound for direct materials, but actually paid \$1.20 per pound. In addition, we expected to pay \$13 an hour for direct labor when in fact we actually paid \$15 an hour. This means we paid 20 percent more than expected for direct materials, which is \$0.20 divided by \$1, and 15 percent more than expected for direct labor, which is \$2 divided by \$13.</i>
Lynn:	<i>I do recall Tony over in purchasing telling me he obtained some premium materials for our ice cream, and I know we hired some relatively experienced workers who were paid a bit more than the normal starting rate.</i>
Tom:	<i>This might explain why our customers were thrilled about our product. The materials were high quality and the production workers really knew their stuff!</i>
Jerry:	<i>While I like the end result of a higher-quality product and increased sales, we must do a better job of controlling costs. Perhaps Tony can negotiate a better price for materials. I don't mind paying our employees a higher wage based on their experience, but let's make sure we get some efficiency savings in the process to help offset the higher wages. Michelle, can we continue to monitor material and labor costs?</i>
Michelle:	<i>Yes. I'll have my staff analyze material and labor variances monthly, and I'll</i>

	<i>have a report ready at the end of each month for you and Lynn.</i>
<i>Jerry:</i>	<i>Excellent! Lynn, let our production crew know they are doing a fine job, and continue to encourage them to find ways to improve the efficiency of production. I'll talk with Tony about the possibility of getting a better deal on materials.</i>

As stated earlier, variance analysis is the control phase of budgeting. Using variance analysis for direct materials and direct labor, Jerry's Ice Cream was able to identify strong points in its operations (quantity of materials used and efficiency of direct labor workforce), and perhaps more important, Jerry's was able to identify problem areas (price paid for materials and wages paid to employees). This information gives the management a way to monitor and control production costs. Next, we calculate and analyze variable manufacturing overhead cost variances.

#### KEY TAKEAWAY

- Standard costs are used to establish the flexible budget for direct labor. The flexible budget is compared to actual costs, and the difference is shown in the form of two variances. The *labor rate variance* focuses on the wages paid for labor and is defined as the difference between actual costs for direct labor and budgeted costs based on the standards. The *labor efficiency variance* focuses on the quantity of labor hours used in production. It is defined as the difference between the actual number of direct labor hours worked and budgeted direct labor hours that should have been worked based on the standards.

#### REVIEW PROBLEM 10.4

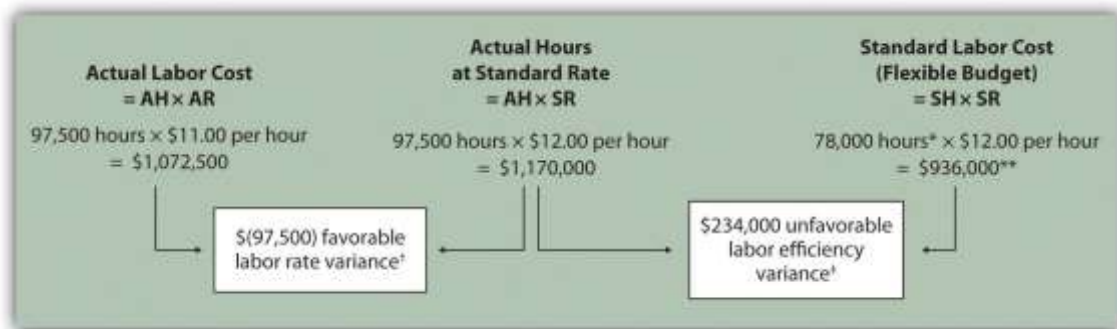
Carol's Cookies expected to use 0.20 direct labor hours to produce 1 unit (batch) of product at a cost of \$12 per hour. Actual results are in for last year, which indicates 390,000 batches of cookies were sold. The company's direct labor workforce worked 97,500 hours at \$11 per hour.

1. Calculate the labor rate and efficiency variances using the format shown in .

- Use the alternative approach to calculating the labor rate and efficiency variances, and compare the result to the result in part 1. (Hint: the variances should match.)
- Suggest several possible reasons for the labor rate and efficiency variances.

#### Solution to Review Problem 10.4

- As shown in the following, the labor rate variance is \$(97,500) favorable, and the labor efficiency variance is \$234,000 unfavorable.



*Note: AH = Actual hours of direct labor. AR = Actual rate incurred for direct labor. SR = Standard rate for direct labor. SH = Standard hours of direct labor for actual level of activity.*

*\*Standard hours of 78,000 = Standard of 0.20 hours per unit  $\times$  390,000 actual units produced and sold.*

*\*\*\$936,000 standard direct labor cost matches the flexible budget presented in , part 2.*

*<sup>†</sup> \$(97,500) favorable labor rate variance = \$1,072,500 – \$1,170,000.*

*Variance is favorable because the actual rate of \$11 is lower than the expected (budgeted) rate of \$12.*

*<sup>‡</sup> \$234,000 unfavorable labor efficiency variance = \$1,170,000 – \$936,000.*

*Variance is unfavorable because the actual hours of 97,500 are higher than the expected (budgeted) hours of 78,000.*

- The following are alternative direct labor variance calculations:

Labor rate variance= $(AR-SR) \times AH = (\$11-\$12) \times 97,500 = (\$97,500)$  favorable (same as part 1)

Labor efficiency variance= $(AH-SH) \times SR = (97,500-78,000) \times \$12 = \$234,000$  unfavorable (same as part 1)

3. *Possible causes of favorable labor rate variance are*

1. A higher mix of newly hired and unskilled workers caused hourly rates to be lower than anticipated;
2. Product demand was lower than expected, thereby reducing the amount of overtime initially anticipated;
3. A new labor contract was negotiated at lower pay rates than anticipated.

*Possible causes of unfavorable labor efficiency variance are*

1. A higher mix of unskilled workers than anticipated caused inefficiencies;
2. Cutbacks in training reduced the expected efficiency of direct labor workers;
3. Old equipment breaking down caused workers to waste time waiting for repairs.

## 10.5 Variable Manufacturing Overhead Variance Analysis

### LEARNING OBJECTIVE

1. Calculate and analyze variable manufacturing overhead variances.

*Question: Similar to direct materials and direct labor variances, variable manufacturing overhead variance analysis involves two separate variances. What are the two variances used to analyze the difference between actual variable overhead costs and standard variable overhead costs?*

Answer: The two variances used to analyze this difference are the spending variance and efficiency variance. The variable overhead spending variance is the difference



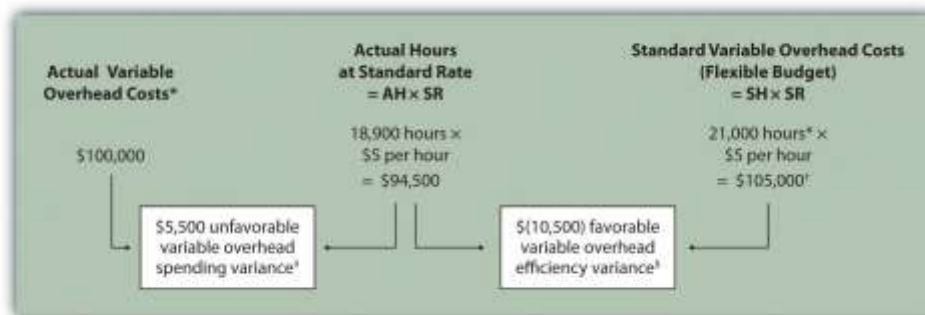
between actual costs for variable overhead and budgeted costs based on the standards. For a company that allocates variable manufacturing overhead to products based on direct labor hours, the variable overhead efficiency variance is the difference between the number of direct labor hours actually worked and what should have been worked based on the standards.

At Jerry’s Ice Cream, the actual data for the year are as follows:

Sales volume	210,000 units
Direct labor hours worked	18,900 hours
Total cost of variable overhead	\$100,000

Recall from that the variable overhead standard rate for Jerry’s is \$5 per direct labor hour and the standard direct labor hours is 0.10 per unit. shows how to calculate the variable overhead spending and efficiency variances given the actual results and standards information. Review this figure carefully before moving on to the next section where these calculations are explained in detail.

Figure 10.8 Variable Manufacturing Overhead Variance Analysis for Jerry’s Ice Cream



Note: AH = Actual hours of direct labor. (This measure will depend on the allocation base that the company uses. Jerry’s uses direct labor hours to allocate variable manufacturing overhead, so AH refers to actual direct labor hours.) SR = Standard variable manufacturing overhead rate per direct labor hour. SH = Standard hours of direct labor for actual level of activity.



\*Since variable overhead is not purchased per direct labor hour, the actual rate (AR) is not used in this calculation. Simply use the total cost of variable manufacturing overhead instead.

\*\*Standard hours of 21,000 = Standard of 0.10 hours per unit  $\times$  210,000 actual units produced and sold.

† \$105,000 standard variable overhead costs matches the flexible budget presented in .

‡ \$5,500 unfavorable variable overhead spending variance = \$100,000 – \$94,500. Variance is unfavorable because the actual variable overhead costs are higher than the expected costs given actual hours of 18,900.

§ \$(10,500) favorable variable overhead efficiency variance = \$94,500 – \$105,000. Variance is favorable because the actual hours of 18,900 are lower than the expected (budgeted) hours of 21,000.

### Variable Overhead Spending Variance Calculation

*Question: How is the variable overhead spending variance calculated?*

Answer: As shown in , the variable overhead spending variance is the difference between what is actually paid for variable overhead and what should have been paid according to the standards:

#### Key Equation

$$\text{Variable overhead spending variance} = \text{Actual costs} - (\text{AH} \times \text{SR})$$

$$\text{Variable overhead spending variance} = \text{Actual costs} - (\text{AH} \times \text{SR}) = \$100,000 - (18,900 \times \$5) = \$5,500 \text{ unfavorable}$$

As with direct materials and direct labor variances, all positive variances are unfavorable, and all negative variances are favorable. Note that there is no alternative calculation for the variable overhead spending variance because variable overhead costs are not purchased per direct labor hour. Thus actual rate (AR) is not used for this variance.



This variance is unfavorable for Jerry's Ice Cream because actual costs of \$100,000 are higher than expected costs of \$94,500.

### Variable Overhead Efficiency Variance Calculation

*Question: How is the variable overhead efficiency variance calculated?*

Answer: As shown in , the variable overhead efficiency variance is the difference between the actual hours worked at the standard rate and the standard hours at the standard rate:

#### Key Equation

$$\text{Variable overhead efficiency variance} = (\text{AH} \times \text{SR}) - (\text{SH} \times \text{SR})$$

$$\text{Variable overhead efficiency variance} = (\text{AH} \times \text{SR}) - (\text{SH} \times \text{SR}) = (18,900 \times \$5) - (21,000 \times \$5) = (\$10,500) \text{ favorable}$$

The 21,000 standard hours are the hours allowed given actual production (= 0.10 standard hours allowed per unit  $\times$  210,000 units produced). Since actual direct labor hours worked total 18,900, the variable manufacturing overhead costs should be lower than initially anticipated at 21,000 standard hours. (This assumes variable overhead costs are truly driven by direct labor hours!) This results in a favorable variable overhead efficiency variance.

Alternative Calculation. Since we are holding the standard rate constant and evaluating the difference between actual hours worked and standard hours, the variable overhead efficiency variance calculation can be simplified as follows:

#### Key Equation

$$\text{Variable overhead efficiency variance} = (\text{AH} - \text{SH}) \times \text{SR}$$

$$\text{Variable overhead efficiency variance} = (\text{AH} - \text{SH}) \times \text{SR} = (18,900 - 21,000) \times \$5 = (\$10,500) \text{ favorable}$$

Note that both approaches—the variable overhead efficiency variance calculation and the alternative calculation—yield the same result.



The variable overhead efficiency variance calculation presented previously shows that 18,900 in actual hours worked is lower than the 21,000 budgeted hours. Again, this variance is favorable because working fewer hours than expected should result in lower variable manufacturing overhead costs.

### Possible Causes of Variable Manufacturing Overhead Variances

*Question: The managerial accountant at Jerry's Ice Cream is interested in finding the cause of the unfavorable variable overhead spending variance of \$5,500. The spending variance can result from variances in the cost of variable overhead items and the usage of these items. What might have caused the \$5,500 unfavorable variable overhead spending variance?*

Answer: The left panel of contains some possible explanations for Jerry's unfavorable overhead spending variance.

Figure 10.9 Possible Causes of Variable Manufacturing Overhead Variances for Jerry's Ice Cream

Unfavorable Variable Overhead Spending Variance	Favorable Variable Overhead Efficiency Variance
<ul style="list-style-type: none"> <li>• A higher mix of skilled indirect labor workers increased hourly rates above expected rates.</li> <li>• A national oil shortage increased factory utility costs above expected costs.</li> <li>• A shutdown of a key supplier increased indirect materials costs.</li> </ul>	<ul style="list-style-type: none"> <li>• A higher mix of skilled direct labor workers made more efficient use of labor hours.</li> <li>• An employee training program improved the efficient use of time.</li> <li>• New production techniques promoted more efficient use of time.</li> <li>• High-quality materials resulted in fewer defective products and more efficient use of time.</li> </ul>

*Question: Jerry's Ice Cream might also choose to investigate the \$10,500 favorable variable overhead efficiency variance. What might have caused the \$10,500 favorable variable overhead efficiency variance?*



Answer: The focus here is on the activity base used to allocate overhead. Since Jerry's uses direct labor hours as the activity base, the possible explanations for this variance are linked to efficiencies or inefficiencies in the use of direct labor. The right panel of contains some possible explanations for this variance.

Again, this analysis is appropriate assuming direct labor hours truly drives the use of variable overhead activities. That is, we assume that an increase in direct labor hours will increase variable overhead costs and that a decrease in direct labor hours will decrease variable overhead costs.

#### Business in Action 10.4

##### Hiding Fraud in Overhead Accounts

The controller of a small, closely held manufacturing company embezzled close to \$1,000,000 over a 3-year period. With annual revenues of \$30,000,000 and less than 100 employees, the company certainly felt the impact of losing \$1,000,000.

The forensic accountant who investigated the fraud identified several suspicious transactions, all of which were charged to the manufacturing overhead account. To prevent this type of fraud in the future, the forensic accountant recommended that "significant manufacturing overhead variances be analyzed both within and across time periods to identify anomalies." Apparently, the company was not closely monitoring manufacturing overhead variances when the fraud occurred.

Source: John B. MacArthur, Bobby E. Waldrup, and Gary R. Fane, "Caution: Fraud Overhead," *Strategic Finance*, October 2004, 28–32.

#### KEY TAKEAWAY

- Standard costs are used to establish the flexible budget for variable manufacturing overhead. The flexible budget is compared to actual costs, and the difference is shown in the form of two variances. The *variable overhead spending variance* represents the difference between actual costs for variable overhead and budgeted costs based on the standards. The *variable overhead efficiency variance* is the difference between the actual activity level in the allocation base (often direct



labor hours or machine hours) and the budgeted activity level in the allocation base according to the standards.

### REVIEW PROBLEM 10.5

Carol's Cookies expected to use 0.20 direct labor hours to produce 1 unit (batch) of product, and the variable overhead rate is \$3.50 per hour. Actual results are in for last year, which indicates 390,000 batches of cookies were produced and sold. The company's direct labor workforce worked 97,500 hours, and variable overhead costs totaled \$360,000.

1. Calculate the variable overhead spending and efficiency variances using the format shown in .
2. Suggest several possible reasons for the variable overhead spending and efficiency variances.

#### Solution to Review Problem 10.5

1. As shown in the following, the variable overhead spending variance is \$18,750 unfavorable, and the variable overhead efficiency variance is \$68,250 unfavorable.



*AH = Actual hours of direct labor. SR = Standard variable manufacturing overhead rate per direct labor hour. SH = Standard hours of direct labor for actual level of activity.*

*\*Since variable overhead is not purchased per direct labor hour, the actual rate (AR) is not used in this calculation. Simply use the total cost of variable manufacturing overhead instead.*

*\*\*Standard hours of 78,000 = Standard of 0.20 hours per unit × 390,000 actual units produced and sold.*

*† \$273,000 standard variable overhead costs match the flexible budget presented in , part 2.*

*‡ \$18,750 unfavorable variable overhead spending variance = \$360,000 – \$341,250. Variance is unfavorable because the actual variable overhead costs are higher than the expected costs given actual hours of 97,500.*

*§ \$68,250 unfavorable variable overhead efficiency variance = \$341,250 – \$273,000. Variance is unfavorable because the actual hours of 97,500 are higher than the expected (budgeted) hours of 78,000.*

*2. Possible causes of unfavorable variable overhead spending variance are*

- 1. A higher mix of skilled indirect labor workers caused hourly rates to be higher than anticipated;*
- 2. Utility costs to run the machines were higher than anticipated due to a nationwide increase in energy costs;*
- 3. A shortage in available indirect materials caused costs to increase unexpectedly.*

*Possible causes of unfavorable variable overhead efficiency variance are*

- 1. A higher mix of unskilled workers than anticipated caused inefficiencies;*
- 2. Cutbacks in training reduced the expected efficiency of direct labor workers;*
- 3. Old equipment breaking down caused workers to waste time waiting for repairs.*

## 10.6 Determining Which Cost Variances to Investigate

### LEARNING OBJECTIVE



1. Determine which variances to investigate.

*Question: Companies rarely investigate all variances because there is a cost associated with identifying the causes of variances. This cost involves employees who spend time talking with personnel from areas including purchasing and production to determine why variances occurred and how to control costs in the future. What can managers do to reduce the cost of investigating variances?*

Answer: Managers typically establish criteria to determine which variances to focus on rather than simply investigating all variances. This is called management by exception. Management by exception describes managers who focus solely on variances that are significant.

*Question: summarizes the cost variances calculated for Jerry's Ice Cream. If you were in charge of investigating variances at Jerry's Ice Cream, how would you determine which variances to focus on and which to ignore?*

Figure 10.10 Summary of Cost Variances at Jerry's Ice Cream

Cost Variances for the Year		
Direct materials price variance*	\$88,000	Unfavorable
Direct materials quantity variance*	(21,000)	Favorable
Direct labor rate variance**	37,800	Unfavorable
Direct labor efficiency variance**	(27,300)	Favorable
Variable overhead spending variance†	5,500	Unfavorable
Variable overhead efficiency variance†	(10,500)	Favorable
Total variable production cost variance	<u>\$72,500</u>	Unfavorable

\*From .

\*\*From .

† From .



Answer: Some managers might review all unfavorable variances. However, the variable overhead spending variance of \$5,500 is not very significant relative to the other variances and may not be worth investigating. Also, by focusing solely on unfavorable variances, managers might overlook problems that may result from favorable variances.

Another approach might be to investigate all favorable and unfavorable variances above a certain minimum level, calculated as a percent of the flexible budget amount. For example, management could establish a policy to investigate all variances at or above 10 percent of the flexible budget amount for each cost. At Jerry's Ice Cream, this would mean investigating all variances at or above \$42,000 for direct materials ( $= 10 \text{ percent} \times \$420,000$ ), \$27,300 for direct labor ( $= 10 \text{ percent} \times \$273,000$ ), and \$10,500 for variable overhead ( $= 10 \text{ percent} \times \$105,000$ ). Based on this policy, the following variances would be investigated:

- Unfavorable direct materials price variance of \$88,000 ( $\geq \$42,000$  minimum)
- Unfavorable direct labor rate variance of \$37,800 ( $\geq \$27,300$  minimum)
- Favorable direct labor efficiency variance of \$(27,300) ( $\geq \$27,300$  minimum)
- Favorable variable overhead efficiency variance of \$(10,500) ( $\geq \$10,500$  minimum)

Many companies calculate and investigate variances weekly, monthly, or quarterly and focus on trends. In this case, they may only investigate variances that are unfavorable and increasing over time.

Whatever the approach, managers understand that investigating variances requires resources. Thus managers must establish an efficient and cost-effective approach to analyzing variances by weighing the benefits derived from investigating variances against the costs incurred to perform the analysis.

#### Business in Action 10.5

##### Using Cost Variances to Detect Fraud

Variance analysis is not only an effective way to control costs; some companies, including **The Dow Chemical Company**, have found that investigating variances can



also help them detect fraudulent activities. **Dow**, which provides chemical, plastic, and agricultural products to customers in 180 countries, has annual sales of \$33,000,000,000 and approximately 46,000 employees. In 1998, the company created a department called Fraud Investigative Services (FIS) whose mission is to “deter and prevent incidents of fraud and financial abuse through detection, investigation, and education.”

The most common types of fraud allegations reviewed by **Dow’s** FIS include expense report fraud, kickback schemes, and embezzlement. Paul Zikmund, the director of FIS, states that “unexplainable cost variances between budget and actual amounts” are among the warning signs he looks for in identifying fraud.

For example, suppose the actual cost for direct materials is significantly higher than the budgeted cost. The cost accountant at **Dow** would begin investigating the cause of the variance by talking with the company’s purchasing agent. The purchasing agent might be unable (or unwilling) to explain why actual costs are so high. Further investigation might indicate that the purchasing agent was intentionally overbilling the vendor and receiving a kickback from the vendor.

Zikmund states that for every \$1 that **Dow** spends on investigating fraud, the company recovers nearly \$4. He also notes that **Dow’s** loss per employee is far below the industry average of \$9 per employee per day. For a company with 46,000 employees, every dollar in savings per employee adds up to a significant amount.

Sources: Paul Zikmund, “Ferretting out Fraud,” *Strategic Finance*, April 2003, 1–4; Dow Chemical Company, “Home Page,” <http://www.dow.com>.

#### KEY TAKEAWAY

- Companies often establish criteria to use in determining which variances to investigate. Some might investigate all variances above a certain dollar amount. Others might investigate variances that are above a certain percentage of the flexible budget. Or management might combine the two and investigate variances above a certain dollar amount and above a certain percentage of the flexible budget.

#### REVIEW PROBLEM 10.6



Use the solutions to , , and to complete the following:

1. Calculate the total variable production cost variance for Carol's Cookies using the format shown in .
2. Assume management investigates all variances at or above 15 percent of the flexible budget amount (e.g., all direct materials variances at or above 15 percent of the direct materials flexible budget are investigated). Identify which of the six variances calculated for direct materials, direct labor, and variable manufacturing overhead management should investigate.

### Solution to Review Problem 10.6

1. See the following figure.

Cost Variances for the Year		
Direct materials price variance*	\$ (128,000)	Favorable
Direct materials quantity variance*	78,000	Unfavorable
Direct labor rate variance**	(97,500)	Favorable
Direct labor efficiency variance**	234,000	Unfavorable
Variable overhead spending variance <sup>†</sup>	18,750	Unfavorable
Variable overhead efficiency variance <sup>†</sup>	68,250	Unfavorable
<b>Total variable production cost variance</b>	<b>\$ 173,500</b>	<b>Unfavorable</b>

\*From .

\*\*From .

<sup>†</sup> From .

2. Based on this policy, the following variances would be investigated:

1. **Direct Materials.** Neither variance would be investigated as both variances fall below \$175,500 (= 15 percent of \$1,170,000 standard cost).
2. **Direct Labor.** The unfavorable direct labor efficiency variance of \$234,000 would be investigated because it falls above \$140,400 (= 15 percent of \$936,000 standard cost).



3. **Variable Overhead.** The unfavorable variable overhead efficiency variance of \$68,250 would be investigated because it falls above \$40,950 (= 15 percent of \$273,000 standard cost).

## 10.7 Using Variance Analysis with Activity-Based Costing

### LEARNING OBJECTIVE

1. Explain how to use cost variance analysis with activity-based costing.

*Question: As discussed in , activity-based costing focuses on identifying activities required to make a product, forming cost pools for each activity, and allocating overhead costs to products based on the products' use of each activity. Rather than establishing one standard variable overhead rate and standard quantity based on one cost driver, activity-based costing establishes several standard variable overhead rates and quantities, each having its own cost driver. How would variance analysis be implemented for a company that uses activity-based costing?*

Answer: Regardless of whether a company uses the traditional costing approach or an activity-based costing approach, the process of performing variance analysis is the same. Similar to the traditional costing approach, the variable overhead spending variance for activity-based costing is calculated for each activity as follows:

#### Key Equation

$$\text{Variable overhead spending variance} = \text{Actual cost} - (\text{AQ} \times \text{SR})$$

The variable overhead efficiency variance is calculated for each activity using activity-based costing as follows:

#### Key Equation

$$\text{Variable overhead efficiency variance} = (\text{AQ} \times \text{SR}) - (\text{SQ} \times \text{SR})$$

Instead of using AH and SH to represent actual hours and standard hours as we did earlier in the chapter, we use AQ and SQ to represent actual quantity and standard quantity for various activities used in activity-based costing.



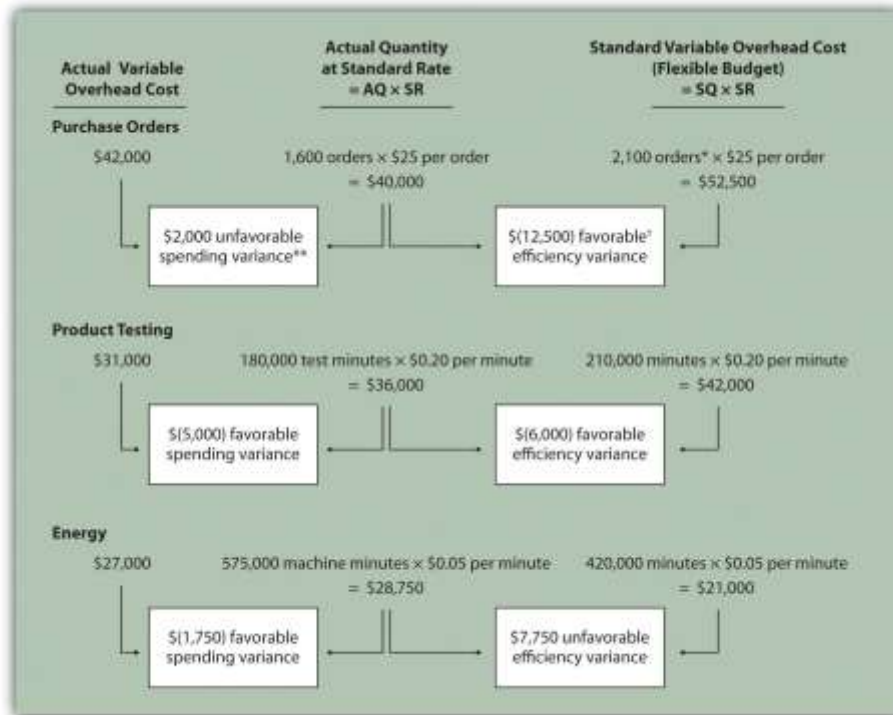
Let's work through an example of variance analysis using activity-based costing. Suppose Jerry's Ice Cream identified three significant activities and established three standard rates to allocate variable manufacturing overhead instead of one rate based on direct labor hours. Information for the three activities for last year is:

Activity	Standard Rate	Standard Quantity per Unit Produced	Actual Costs	Actual Quantity
Purchase orders	\$25 per purchase order	0.01 orders per unit	\$42,000	1,600 purchase orders
Product testing	\$0.20 per test minute	1 minute per unit	\$31,000	180,000 test minutes
Energy	\$0.05 per minute of machine time	2 minutes per unit	\$27,000	575,000 minutes of machine time

Recall that Jerry's produced 210,000 units for the year. shows the resulting variable overhead variance analysis. Notice that the format for is the same as for . The variance calculations are also the same except variances are calculated for three activities rather than one. Note that total actual variable overhead costs remain at \$100,000, but they are simply broken out into 3 activities ( $\$100,000 = \$42,000$  for purchase orders +  $\$31,000$  for product testing +  $\$27,000$  for energy costs). Also, the flexible budget presented in , totaling \$115,500, differs from the flexible budget presented earlier since Jerry's is using a different cost system in this example, which often results in different budgeted amounts ( $\$115,500 = \$52,500$  purchase orders +  $\$42,000$  product testing +  $\$21,000$  energy).

Figure 10.11 Variable Overhead Variance Analysis for Jerry's Ice Cream Using Activity-Based Costing





Note: AQ = Actual quantity of activity. SR = Standard variable manufacturing overhead rate per unit of activity. SQ = Standard quantity of activity given actual production of 210,000 units.

\*Standard quantity of 2,100 purchase orders = Standard of 0.01 purchase orders per unit × 210,000 actual units produced.

\*\*\$2,000 unfavorable variable overhead spending variance = \$42,000 – \$40,000. Variance is unfavorable because the actual variable overhead cost is higher than the expected cost given actual quantity of 1,600 purchase orders.

† \$(12,500) favorable variable overhead efficiency variance = \$40,000 – \$52,500. Variance is favorable because the 1,600 actual purchase orders are lower than the 2,100 expected (budgeted) purchase orders.

This type of costing system and resulting variance analysis provides management with further information regarding variable overhead costs and variances. As discussed earlier, management often establishes criteria to decide which variances to investigate. Assume that management of Jerry's Ice Cream chooses to investigate the \$7,750 unfavorable efficiency variance associated

with energy. The management would like to know why 575,000 minutes of actual machine time were used instead of the expected 420,000 minutes. Perhaps the machines were operating poorly due to cutbacks in maintenance, or maybe new employees were not as efficient using the machines. Whatever the cause, Jerry's has identified the issue by integrating its activity-based costing system with the cost variance analysis concepts discussed in this chapter.

**KEY TAKEAWAY**

- Using cost variance analysis with activity-based costing is much like using cost variance analysis with traditional costing. Both utilize a spending variance and an efficiency variance. However, activity-based costing requires calculating a spending and efficiency variance for each activity rather than only one activity base typically used in traditional costing.

**REVIEW PROBLEM 10.7**

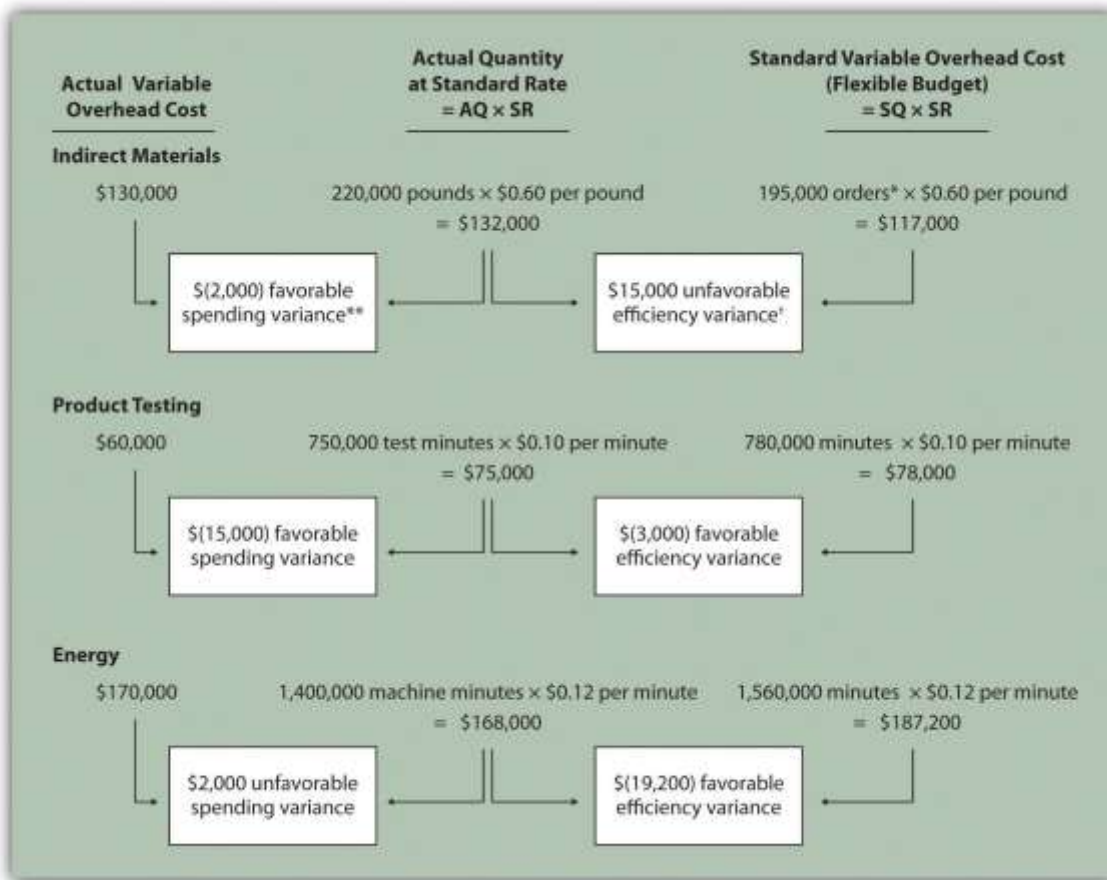
Assume Carol's Cookies uses activity-based costing to allocate variable manufacturing overhead costs instead of one rate based on direct labor hours. Carol identified three activities with the following information for last year.

Activity	Standard Rate	Standard Quantity per Unit Produced	Actual Costs	Actual Quantity
Indirect materials	\$0.60 per pound	0.5 pounds per unit	\$130,000	220,000 pounds
Product testing	\$0.10 per test minute	2 minutes per unit	\$ 60,000	750,000 test minutes
Energy	\$0.12 per minute of machine time	4 minutes per unit	\$170,000	1,400,000 minutes of machine time

Recall that Carol's Cookies produced and sold 390,000 units for the year. Prepare a variance analysis for Carol's Cookies using the format shown in.

Solution to Review Problem 10.7





Note: AQ = Actual quantity of activity. SR = Standard variable manufacturing overhead rate per unit of activity. SQ = Standard quantity of activity given actual production of 210,000 units.

\*Standard quantity of 195,000 pounds = Standard of 0.5 pounds per unit × 390,000 actual units produced.

\*\*\$ (2,000) favorable variable overhead spending variance = \$130,000 – \$132,000. Variance is favorable because the actual variable overhead cost is lower than the expected cost given actual quantity of 220,000 pounds.

† \$15,000 unfavorable variable overhead efficiency variance = \$132,000 – \$117,000. Variance is unfavorable because the 220,000 actual pounds is higher than the 195,000 expected (budgeted) pounds.

## 10.8 Fixed Manufacturing Overhead Variance Analysis

### LEARNING OBJECTIVE

1. Calculate and analyze fixed manufacturing overhead variances.

*Question: Many organizations also analyze fixed manufacturing overhead variances. Recall from earlier chapters that manufacturing companies are required to assign fixed manufacturing overhead costs to products for financial reporting purposes (this is called absorption costing). It is common for companies such as Jerry's Ice Cream to apply fixed manufacturing overhead costs to products based on direct labor hours, machine hours, or some other activity. Companies using a standard costing system apply fixed overhead based on a standard dollar amount per unit produced (this calculation is shown in the footnote to ). Assume Jerry's uses direct labor hours to assign fixed overhead costs to products shown in . How is this information used to perform fixed overhead cost variance analysis?*

Answer: It is important to start by noting that fixed overhead in the master budget is the same as fixed overhead in the flexible budget because, by definition, fixed costs do not change with changes in units produced. Thus budgeted fixed overhead costs of \$140,280 shown in will remain the same even though Jerry's actually produced 210,000 units instead of the master budget expectation of 200,400 units.

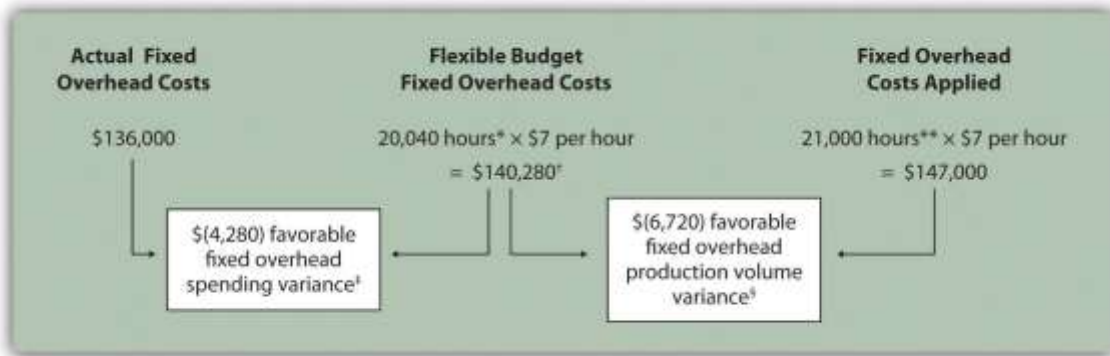
Figure 10.12 Fixed Manufacturing Overhead Information for Jerry's Ice Cream

Budgeted fixed overhead costs	\$140,280
Budgeted direct labor hours	÷ 20,040 hours
Standard cost per direct labor hours*	<u>\$ 7</u> per hour
Standard direct labor hours per unit	0.10 hours
Actual production	210,000 units
Actual fixed overhead costs	\$136,000
*Standard fixed manufacturing overhead cost can also be stated on a per unit basis as follows:	
Standard cost per direct labor hour	\$ 7.00
Standard direct labor hours per unit	× 0.10
Standard fixed overhead cost per unit	<u>\$ 0.70</u>



Fixed manufacturing overhead variance analysis involves two separate variances: the spending variance and the production volume variance. We show both variances in , and provide further detail following the figure.

Figure 10.13 Fixed Manufacturing Overhead Variance Analysis for Jerry’s Ice Cream



\*From , the direct labor budget is 20,040 budgeted direct labor hours = 200,400 units budgeted to be produced × 0.10 direct labor hours per unit.

\*\*Standard hours of 21,000 = 210,000 actual units produced and sold × Standard of 0.10 hours per unit.

† \$140,280 is the original budget presented in the manufacturing overhead budget shown in . The flexible budget amount for fixed overhead does not change with changes in production, so this amount remains the same regardless of actual production.

‡ \$(4,280) favorable fixed overhead spending variance = \$136,000 – \$140,280. Variance is favorable because the actual fixed overhead costs are lower than the budgeted costs.

§ \$(6,720) favorable fixed overhead volume variance = \$140,280 – \$147,000. Variance is favorable because the volume of goods produced and sold was higher than expected.

### Fixed Overhead Spending Variance Calculation

*Question: How is the fixed overhead spending variance calculated?*

Answer: The fixed overhead spending variance is the difference between actual and budgeted fixed overhead costs. As shown in , Jerry's Ice Cream incurred \$136,000 in fixed overhead costs for the year. Budgeted fixed overhead costs totaled \$140,280. Thus the spending variance is calculated as follows:

#### Key Equation

Fixed overhead spending variance = Actual costs – Budgeted costs

Fixed overhead spending variance=Actual costs – Budgeted costs=\$136,000–\$140,280=(\$4,280)  
favorable

Because fixed overhead costs are not typically driven by activity, Jerry's cannot attribute any part of this variance to the efficient (or inefficient) use of labor. In fact, there is no efficiency variance for fixed overhead. Instead, Jerry's must review the detail of actual and budgeted costs to determine why the favorable variance occurred. For example, factory rent, supervisor salaries, or factory insurance may have been lower than anticipated. Further investigation of detailed costs is necessary to determine the exact cause of the fixed overhead spending variance.

### Fixed Overhead Production Volume Variance Calculation

*Question: How is the fixed overhead production volume variance calculated?*

Answer: Before discussing the production volume variance, a word of caution: do not equate the fixed overhead production volume variance with the variable overhead efficiency variance. There is no efficiency variance for fixed manufacturing overhead because, by definition, fixed costs do not change with changes in the activity base. The fixed overhead volume variance is solely a result of the difference in budgeted production and actual production. The fixed overhead production volume variance is the difference between the budgeted and applied fixed overhead costs. As shown in , Jerry's Ice Cream budgeted \$140,280 in fixed overhead costs for the year. Fixed overhead costs applied totaled \$147,000. Thus the production volume variance is calculated as follows:



### Key Equation

Fixed overhead production volume variance = Budgeted costs – Applied costs

Fixed overhead production volume variance = Budgeted costs – Applied costs = \$140,280 – \$147,000  
= (\$6,720) favorable

The fixed overhead production volume variance is a direct result of the difference in volume (units) between budgeted production and actual production. All other variables are held constant including standard direct labor hours per unit (0.10) and standard rate per direct labor hour (\$7). Thus an alternative approach to this calculation can be used assuming the standard fixed overhead cost per unit is \$0.70 (= 0.10 direct labor hours per unit × \$7 per direct labor hour):

### Key Equation

Fixed overhead production volume variance = Standard fixed overhead cost per unit × (Budgeted units produced – Actual units produced)

Fixed overhead production volume variance (\$6,720) favorable = Standard fixed overhead cost per unit = \$0.70 × ((Budgeted units produced (200,400 budgeted units) – Actual units produced) 210,000 actual units)

The fixed overhead production volume variance is favorable because the company produced and sold more units than anticipated.

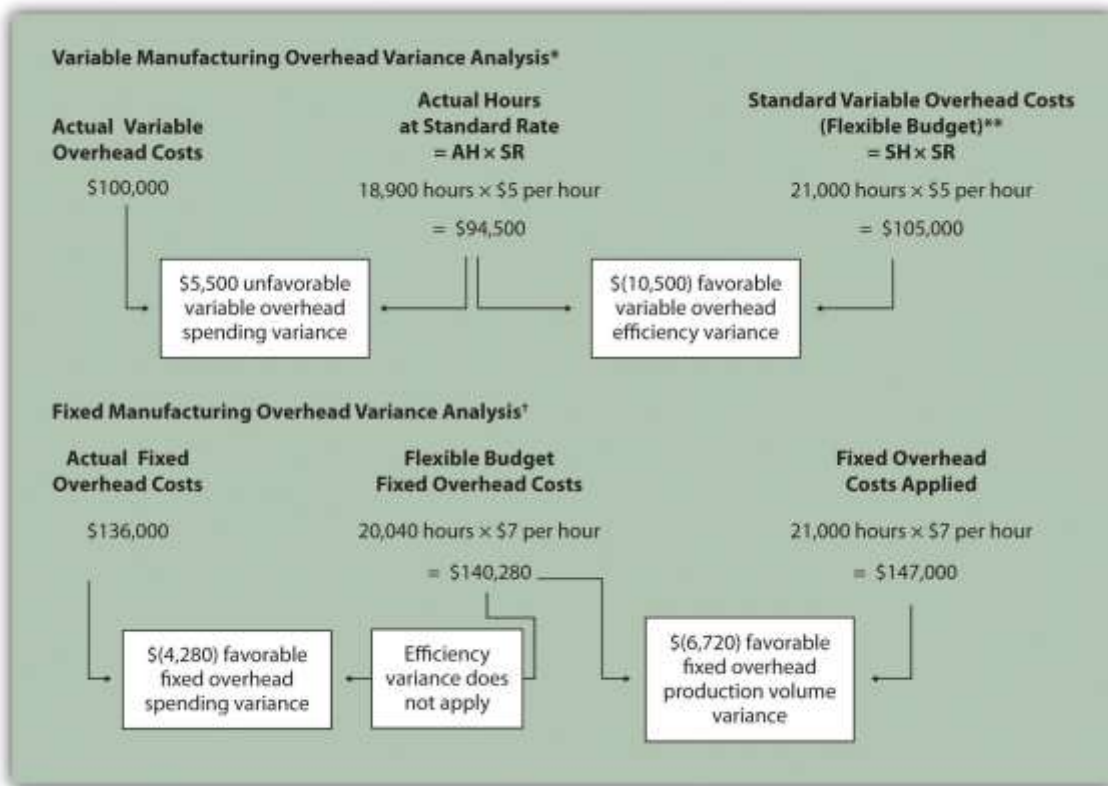
## Comparison of Fixed and Variable Overhead Variances

*Question: What are the similarities and differences between the fixed and variable overhead variances?*

*Answer:* summarizes the similarities and differences between variable and fixed overhead variances. Notice that the efficiency variance is not applicable to the fixed overhead variance analysis.

Figure 10.14 Comparison of Variable and Fixed Manufacturing Overhead Variance Analysis for Jerry's Ice Cream





\*Information is from .

\*\*For variable manufacturing overhead, the flexible budget is the same as variable overhead applied to production.

† Information is from .

### KEY TAKEAWAY

- Two variances are calculated and analyzed when evaluating fixed manufacturing overhead. The *fixed overhead spending variance* is the difference between actual and budgeted fixed overhead costs. The *fixed overhead production volume variance* is the difference between budgeted and applied fixed overhead costs. There is no efficiency variance for fixed manufacturing overhead.

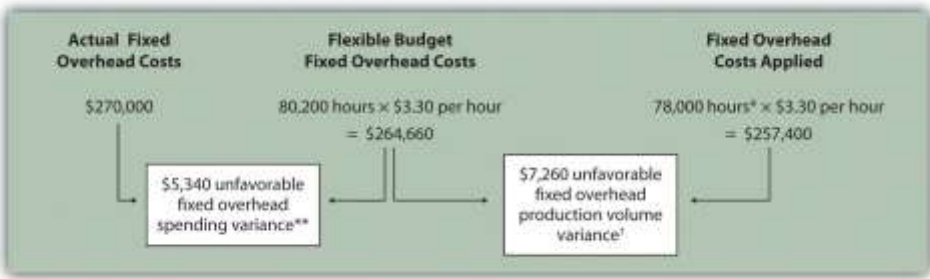
### REVIEW PROBLEM 10.8

This review problem is based on the budget information presented in review problems and variance analysis information presented in review problems. The following information is for Carol's Cookies:

Budgeted fixed overhead costs	\$264,660
Budgeted direct labor hours	÷ 80,200
Standard cost per direct labor hours	<u>\$ 3.30</u>
Standard direct labor hours per unit	0.20
Actual production	390,000 units
Actual fixed overhead costs	\$270,000

Calculate the fixed overhead spending and production volume variances using the format shown in .

Solution to Review Problem 10.8



\*Standard hours of 78,000 = 390,000 actual units produced and sold x standard of 0.20 hours per unit.

\*\*\$5,340 unfavorable fixed overhead spending variance = \$270,000 – \$264,660.

Variance is unfavorable because the actual fixed overhead costs are higher than the budgeted costs.

† \$7,260 unfavorable fixed overhead volume variance = \$264,660 – \$257,400.

Variance is unfavorable because the volume of goods produced and sold was lower than expected.

## 10.9 Appendix: Recording Standard Costs and Variances

### LEARNING OBJECTIVE

1. Explain how to record standard costs and variances using journal entries.

This chapter has focused on performing variance analysis to evaluate and control operations. Standard costing systems assist in this process and often involve recording transactions using standard cost information. When accountants use a standard costing system to record transactions, companies are able to quickly identify variances. In addition, inventory and related cost of goods sold are valued using standard cost information, which simplifies the bookkeeping process.

### Recording Direct Materials Transactions

*Question: In Figure 10.4 "Direct Materials Variance Analysis for Jerry's Ice Cream", we calculated two variances for direct materials at Jerry's Ice Cream: materials price variance and materials quantity variance. How are these variances recorded for transactions related to direct materials?*

Answer: Two journal entries are needed to record direct materials transactions that include these variances. An example of each is shown next. (Typically, many more journal entries would be made throughout the year for direct materials. For the purposes of this example, we will make one journal entry for each variance to summarize the activity for the year.)

### Materials Price Variance

The entry to record the *purchase* of direct materials and related price variance shown in [Figure 10.4 "Direct Materials Variance Analysis for Jerry's Ice Cream"](#) is

Dr. raw materials inventory (440,000 pounds × \$1.00 per pound)	440,000	
Dr. materials price variance (\$88,000 unfavorable)	88,000	
Cr. accounts payable (440,000 pounds × \$1.20 per pound)		528,000

Notice that the raw materials inventory account contains the actual quantity of direct materials purchased at the standard price. Accounts payable reflects the actual cost, and the materials price variance account shows the unfavorable variance. Unfavorable variances are recorded as debits and favorable variances are recorded as credits. Variance accounts are temporary accounts that are closed out at the end of the financial reporting period. We show the process of closing out variance accounts at the end of this appendix.

### Materials Quantity Variance

The entry to record the use of direct materials in production and related quantity variance shown in Figure 10.4 "Direct Materials Variance Analysis for Jerry's Ice Cream" is

Dr. work in process inventory (420,000 pounds × \$1.00 per pound)	420,000	
Cr. materials quantity variance (\$21,000 favorable)		21,000
Cr. raw materials inventory (399,000 pounds × \$1.00 per pound)		399,000

Work-in-process inventory reflects the standard quantity of direct materials allowed at the standard price. The reduction in raw materials inventory reflects the actual quantity used at the standard price, and the materials quantity variance account shows the favorable variance.

### Recording Direct Labor Transactions

*Question: In Figure 10.6 "Direct Labor Variance Analysis for Jerry's Ice Cream", we calculated two variances for direct labor at Jerry's Ice Cream: labor rate variance and labor efficiency variance. How are these variances recorded for transactions related to direct labor?*

*Answer: Because labor is not inventoried for later use like materials, only one journal entry is needed to record direct labor transactions that include these variances. (Again, many more journal entries would typically be made throughout the year for direct labor. For the purposes of this example, we will make one journal entry to summarize the activity for the year.)*

## Labor Rate and Efficiency Variances

The entry to record the cost of direct labor and related variances shown in Figure 10.6 "Direct Labor Variance Analysis for Jerry's Ice Cream" is

Dr. work in process inventory (21,000 hours × \$13 per hour)	273,000	
Dr. labor rate variance (\$37,800 unfavorable)	37,800	
Cr. labor efficiency variance (\$27,300 favorable)		27,300
Cr. wages payable (18,900 hours × \$15 per hour)		283,500

Work-in-process inventory reflects the standard hours of direct labor allowed at the standard rate. The labor rate and efficiency variances represent the difference between work-in-process inventory (at the standard cost) and actual costs recorded in wages payable.

## Recording Manufacturing Overhead Transactions

*Question: As discussed in Chapter 2 "How Is Job Costing Used to Track Production Costs?", the manufacturing overhead account is debited for all actual overhead expenditures and credited when overhead is applied to products. At the end of the period, the balance in manufacturing overhead, representing overapplied or underapplied overhead, is closed out to cost of goods sold. This overapplied or underapplied balance can be explained by combining the four overhead variances summarized in this chapter in Figure 10.14 "Comparison of Variable and Fixed Manufacturing Overhead Variance Analysis for Jerry's Ice Cream". How are these variances recorded for transactions related to manufacturing overhead?*

Answer: Based on the information at the left side of Figure 10.14 "Comparison of Variable and Fixed Manufacturing Overhead Variance Analysis for Jerry's Ice Cream", the entry to record actual overhead expenditures is

Dr. manufacturing overhead (\$100,000 variable + \$136,000 fixed)	236,000	
Cr. various accounts		236,000





The credit goes to several different accounts depending on the nature of the expenditure. For example, if the expenditure is for indirect materials, the credit goes to accounts payable. If the expenditure is for indirect labor, the credit goes to wages payable.

The next entry reflects overhead applied to products. This information comes from the right side of Figure 10.14 "Comparison of Variable and Fixed Manufacturing Overhead Variance Analysis for Jerry's Ice Cream".

Dr. work in process inventory (\$105,000 variable + \$147,000 fixed)	252,000	
Cr. manufacturing overhead		252,000

At this point, manufacturing overhead has a \$16,000 credit balance, which represents overapplied overhead (\$16,000 = \$252,000 applied overhead – \$236,000 actual overhead). The following summary of fixed and variable overhead variances shown in Figure 10.14 "Comparison of Variable and Fixed Manufacturing Overhead Variance Analysis for Jerry's Ice Cream" explains the overapplied amount of \$16,000:

Variable overhead spending variance	\$ 5,500	Unfavorable
Variable overhead efficiency variance	(10,500)	Favorable
Fixed overhead spending variance	(4,280)	Favorable
Fixed overhead production volume variance	(6,720)	Favorable
Total overapplied overhead	<u>\$ (16,000)</u>	Favorable

### Recording Finished Goods Transactions

*Question: Review all the debits to work-in-process inventory throughout this appendix and you will see the following costs (all recorded at standard cost):*

Raw materials	\$420,000
Direct labor	273,000
Manufacturing overhead	252,000
Total	<u>\$945,000</u>



*How are these costs transferred from work-in-process inventory to finished good inventory when the goods are completed?*

Answer: When the 210,000 units are completed, the following entry is made to transfer the costs out of work-in-process inventory and into finished goods inventory.

Dr. finished goods inventory Cr. work in process inventory	945,000	945,000
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Note that the standard cost per unit was established at \$4.50, which includes variable manufacturing costs of \$3.80 (see Figure 10.1 "Standard Costs at Jerry's Ice Cream") and fixed manufacturing costs of \$0.70 (see footnote to Figure 10.12 "Fixed Manufacturing Overhead Information for Jerry's Ice Cream"). Total production of 210,000 units  $\times$  Standard cost of \$4.50 per unit equals \$945,000; the same amount you see in the entry presented previously.

### Recording Cost of Goods Sold Transactions

*Question: How do we record the costs associated with products that are sold?*

Answer: When finished product is sold, the following entry is made:

Dr. costs of goods sold Cr. finished goods inventory	945,000	945,000
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Note that the entry shown previously uses standard costs, which means cost of goods sold is stated at standard cost until the next entry is made.

## Closing Manufacturing Overhead and Variance Accounts

*Question: At the end of the period, Jerry's Ice Cream has balances remaining in manufacturing overhead along with all the variance accounts. These accounts must be closed out at the end of the period. How is this accomplished?*

Answer: These accounts are closed out to cost of goods sold, after which point cost of goods sold will reflect actual manufacturing costs for the products sold during the period. The following entry is made to accomplish this goal:

Dr. cost of goods sold	61,500*	
Dr. materials quantity variance	21,000	
Dr. labor efficiency variance	27,300	
Dr. manufacturing overhead	16,000	
Cr. materials price variance		88,000
Cr. labor rate variance		37,800

\* $\$61,500 = \$88,000 + \$37,800 - \$21,000 - \$27,300 - \$16,000$ .

### KEY TAKEAWAY

- In a standard costing system, all inventory accounts reflect standard cost information. The difference between standard and actual data are recorded in the variance accounts and the manufacturing overhead account, which are ultimately closed out to cost of goods sold at the end of the period.

### REVIEW PROBLEM 10.9

1. Using the solution to [Note 10.30 "Review Problem 10.3"](#), prepare a journal entry to record the purchase of raw materials.
2. Using the solution to [Note 10.30 "Review Problem 10.3"](#), prepare a journal entry to record the use of raw materials.
3. Using the solution to [Note 10.40 "Review Problem 10.4"](#), prepare a journal entry to record direct labor costs.



4. Using the solutions to [Note 10.49 "Review Problem 10.5"](#) and [Note 10.67 "Review Problem 10.8"](#), prepare a journal entry to record actual variable and fixed manufacturing overhead expenditures.
5. Using the solutions to [Note 10.49 "Review Problem 10.5"](#) and [Note 10.67 "Review Problem 10.8"](#), prepare a journal entry to record variable and fixed manufacturing overhead applied to products.
6. Based on the entries shown in items **1** through **5**, prepare a journal entry to transfer all work-in-process inventory costs to finished goods inventory.
7. Assume all finished goods are sold during the period. Prepare a journal entry to transfer all finished goods inventory costs to cost of goods sold.
8. Based on the entries shown in items **1** through **7**, close manufacturing overhead and all variance accounts to cost of goods sold.

#### Solution to Review Problem 10.9

1. The following is a journal entry to record purchase of raw materials:

Dr. raw materials inventory (640,000 pounds × \$2.00 per pound)	1,280,000	
Cr. materials price variance (\$128,000 favorable)		128,000
Cr. accounts payable (640,000 pounds × \$1.80 per pound)		1,152,000

2. The following is a journal entry to record usage of raw materials:

Dr. work in process inventory (585,000 pounds × \$2 per pound)	1,170,000	
Dr. materials quantity variance (\$78,000 unfavorable)	78,000	
Cr. raw materials inventory (624,000 pounds × \$2 per pound)		1,248,000

3. The following is a journal entry to record direct labor costs:

Dr. work in process inventory (78,000 hours × \$12 per hour)	936,000	
Dr. labor efficiency variance (\$234,000 unfavorable)	234,000	
Cr. labor rate variance (\$97,500 favorable)		97,500
Cr. wages payable (97,500 hours × \$11 per hour)		1,072,500

4. The following is a journal entry to record actual overhead expenditures:

Dr. manufacturing overhead (\$360,000 variable + \$270,000 fixed)	630,000	
Cr. various accounts		630,000

5. The following is a journal entry to record overhead applied to production:

Dr. work in process inventory (\$273,000 variable + \$257,400 fixed)	530,400	
Cr. manufacturing overhead		530,400

6. The product cost data recorded in work-in-process inventory for the period is as follows:

Raw materials	\$1,170,000 (from entry 2)
Direct labor	936,000 (from entry 3)
Manufacturing overhead	530,400 (from entry 5)
Total	<u>\$2,636,400</u>

Thus the journal entry to transfer these production costs from work in process to finished goods is:

Dr. finished goods inventory	2,636,400	
Cr. work in process inventory		2,636,400

7. The following is a journal entry to record transfer of finished goods to cost of goods sold:

Dr. costs of goods sold	2,636,400	
Cr. finished goods inventory		2,636,400

8. The following is a journal entry to close out manufacturing overhead and all variance accounts:

Dr. cost of goods sold	186,100*	
Dr. materials price variance	128,000	
Dr. labor rate variance	97,500	
Cr. materials quantity variance		78,000
Cr. labor efficiency variance		234,000
Cr. manufacturing overhead		99,600**

\*\$186,100 = \$78,000 + \$234,000 + \$99,600 – \$128,000 – \$97,500.

\*\*\$99,600 underapplied overhead = \$630,000 actual overhead costs – \$530,400 applied overhead. Because this represents a debit balance in manufacturing overhead, the account must be credited to close it. To further prove this is accurate, the sum of all overhead variances must equal \$99,600 unfavorable as shown in the following:

Variable overhead spending variance	\$18,750 unfavorable (from Note 10.49 "Review Problem 10.5")
Variable overhead efficiency variance	\$68,250 unfavorable (from Note 10.49 "Review Problem 10.5")
Fixed overhead spending variance	\$5,340 unfavorable (from Note 10.67 "Review Problem 10.8")
Fixed overhead production volume	\$7,260 unfavorable (from Note 10.67 "Review Problem 10.8")



variance	Problem 10.8")
Total manufacturing overhead variance	\$99,600 unfavorable

## END-OF-CHAPTER EXERCISES

### Questions

1. Explain how a flexible budget differs from a master budget.
2. Assume you are the production manager for a manufacturing company that anticipated selling 40,000 units of product for the master budget and actually sold 50,000 units. Why would you prefer to be evaluated using a flexible budget for direct labor rather than the master budget?
3. What is a standard cost, and how does it differ from a budgeted cost?
4. How are standards established for direct materials, direct labor, and variable manufacturing overhead?
5. Explain what management is trying to evaluate in reviewing the materials price variance and materials quantity variance. Be sure to include the formula for each variance in your explanation.
6. Explain what management is trying to evaluate in reviewing the labor rate variance and labor efficiency variance. Be sure to include the formula for each variance in your explanation.
7. Explain how an unfavorable labor rate variance might cause a favorable labor efficiency variance and favorable materials quantity variance.
8. The production manager just received a report indicating an unfavorable labor rate variance. Further investigation reveals that the sales department accepted a large rush order. Who should be held responsible for the unfavorable variance? Explain.
9. Refer to [Note 10.38 "Business in Action 10.3"](#) Why is direct labor variance analysis particularly important for **United Airlines**?
10. Are favorable variances always a result of good management decisions? Explain.
11. Do most companies investigate all variances? Explain.



12. How is variable overhead variance analysis similar for companies using activity-based costing and companies using traditional costing?
13. What causes the fixed overhead production volume variance?
14. **(Appendix).** Why are direct materials and direct labor variance accounts needed in a standard costing system? What happens to these accounts at the end of the period?

#### Brief Exercises

15. **Analyzing Costs at Jerry's Ice Cream.** Refer to the dialogue at Jerry's Ice Cream presented at the beginning of the chapter. What happened with direct labor and direct materials costs at Jerry's Ice Cream? What did Jerry, the owner, ask Michelle to do?
16. **Direct Materials Standard Cost and Flexible Budget.** Manhattan Company produces high-quality chairs. Each chair requires a standard quantity of 10 board feet of wood at \$5 per board foot. Production for July totaled 3,000 units. Calculate (a) standard cost per unit for direct materials and (b) flexible budget amount for direct materials for the month of July.
17. **Direct Labor Standard Cost and Flexible Budget.** Manhattan Company produces high-quality chairs. Each chair requires a standard quantity of 8 direct labor hours at \$15 per hour. Production for July totaled 3,000 units. Calculate (a) standard cost per unit for direct labor and (b) flexible budget amount for direct labor for the month of July.
18. **Variable Overhead Standard Cost and Flexible Budget.** Manhattan Company produces high-quality chairs. Variable manufacturing overhead is applied at a standard rate of \$10 per machine hour. Each chair requires a standard quantity of three machine hours. Production for July totaled 3,000 units. Calculate (a) standard cost per unit for variable overhead and (b) flexible budget amount for variable overhead for the month of July.
19. **Materials Price Variance.** Sweets Company produces boxes of chocolate. The company expects to pay \$5 a pound for chocolate. Sweets purchased 4,000 pounds of chocolate during the month of April for \$4.80 per pound. Calculate the materials price variance for the month of April.





20. **Materials Quantity Variance.** Sweets Company produces boxes of chocolate. A standard of 2 pounds of material is expected to be used for each box produced, at a cost of \$5 per pound. Sweets produced 1,000 boxes of chocolate during the month of April and used 2,200 pounds of chocolate. Calculate the materials quantity variance for the month of April.
21. **Labor Rate Variance.** Tech Company produces computer servers. The company's standards show an expected direct labor rate of \$20 per hour. Tech's direct labor workforce worked 3,200 hours to produce 300 units during the month of August and was paid \$22 per direct labor hour. Calculate the labor rate variance for the month of August.
22. **Labor Efficiency Variance.** Tech Company produces computer servers. The company's standards show that each server will require 10 hours of direct labor at \$20 per hour. Tech produced 300 units during the month of August and direct labor hours totaled 3,200 for the month. Calculate the labor efficiency variance for the month of August.
23. **Variable Overhead Spending Variance.** Tech Company produces computer servers. Variable overhead is allocated to each server based on a standard of \$100 per machine hour. A total of 850 machine hours were used during the month of August and variable overhead costs totaled \$96,000. Calculate the variable overhead spending variance for the month of August.
24. **Variable Overhead Efficiency Variance.** Tech Company produces computer servers. Variable overhead is allocated to each server based on a standard of \$100 per machine hour and 3 machine hours per server. A total of 850 machine hours were used during the month of August to produce 300 servers. Calculate the variable overhead efficiency variance for the month of August.
25. **Investigating Variances.** Fiber Optic, Inc., investigates all variances above 10 percent of the flexible budget. The flexible budget for direct materials is \$50,000. The direct materials price variance is \$4,000 unfavorable and the direct materials quantity variance is \$(6,000) favorable. Which variances should be investigated according to company policy? Show calculations to support your answer.



26. **Spending Variance Using Activity-Based Costing.** Albany, Inc., uses activity-based costing to allocate variable manufacturing overhead costs to products. One of the activities used to allocate these costs is product testing. The standard rate is \$15 per test hour. The cost for this activity during June totaled \$2,000, and actual test time during June totaled 120 hours. Calculate the spending variance for this activity for the month of June, and clearly label whether the variance is favorable or unfavorable.
27. **Fixed Overhead Spending Variance.** Sampson Company applies fixed manufacturing overhead costs to products based on direct labor hours. Budgeted direct labor hours for the month of January totaled 30,000 hours, with a standard cost per direct labor hour of \$12. Actual fixed overhead costs totaled \$350,000 for January. Calculate the fixed overhead spending variance for January, and clearly label whether the variance is favorable or unfavorable.
28. **(Appendix) Journalizing the Purchase of Raw Materials.** Mill Company purchased 40,000 pounds of raw materials on account for \$3.40 per pound. The standard price is \$3 per pound. Prepare a journal entry to record this transaction assuming the company uses a standard costing system.

Exercises: Set A

29. **Standard Cost and Flexible Budget.** Hal's Heating produces furnaces for commercial buildings. The company's master budget shows the following standards information.

Expected production for January	300 furnaces
Direct materials	3 heating elements at \$40 per element
Direct labor	35 hours per furnace at \$18 per hour
Variable manufacturing overhead	35 direct labor hours per furnace at \$15 per hour

30. *Required:*

- a. Calculate the standard cost per unit for direct materials, direct labor, and variable manufacturing overhead using the format shown in [Figure 10.1 "Standard Costs at Jerry's Ice Cream"](#).
- b. Assume Hal's Heating produced 320 furnaces during January. Prepare a flexible budget for direct materials, direct labor, and variable manufacturing overhead using the format shown in [Figure 10.2 "Flexible Budget for Variable Production Costs at Jerry's Ice Cream"](#).

**Materials and Labor Variances.** Hal's Heating produces furnaces for commercial buildings. (This is the same company as the previous exercise. This exercise can be assigned independently.)

For direct materials, the standard price for a heating element part is \$40. A standard quantity of 3 heating elements is expected to be used in each furnace produced. During January, Hal's Heating purchased 1,000 heating elements for \$38,000 and used 980 heating elements to produce 320 furnaces.

For direct labor, Hal's Heating established a standard number of direct labor hours at 35 hours per furnace. The standard rate is \$18 per hour. A total of 10,000 direct labor hours were worked during January, at a cost of \$190,000, to produce 320 furnaces.

*Required:*

- a. Calculate the materials price variance and materials quantity variance using the format shown in [Figure 10.4 "Direct Materials Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.
- b. Calculate the labor rate variance and labor efficiency variance using the format shown in [Figure 10.6 "Direct Labor Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.

**Variable Overhead Variances.** Hal’s Heating produces furnaces for commercial buildings. (This is the same company as the previous exercises. This exercise can be assigned independently.) The company applies variable manufacturing overhead at a standard rate of \$15 per direct labor hour. The standard quantity of direct labor is 35 hours per unit. Variable overhead costs totaled \$190,000 for the month of January. A total of 10,000 direct labor hours were worked during January to produce 320 furnaces.

*Required:*

Calculate the variable overhead spending variance and variable overhead efficiency variance using the format shown in [Figure 10.8 "Variable Manufacturing Overhead Variance Analysis for Jerry’s Ice Cream"](#). Clearly label each variance as favorable or unfavorable.

**Fixed Overhead Variance Analysis.** Hal’s Heating produces furnaces for commercial buildings. (This is the same company as the previous exercises. This exercise can be assigned independently.) The company applies fixed manufacturing overhead costs to products based on direct labor hours. Information for the month of January appears as follows. Hal’s expected to produce and sell 300 units for the month.

Budgeted fixed overhead costs	\$ 231,000
Budgeted direct labor hours	÷ 10,500
Standard cost per direct labor hour	<u>\$ 22</u>
Standard direct labor hours per unit	35
Actual production	320 units
Actual fixed overhead costs	\$ 217,000

*Required:*

Calculate the fixed overhead spending variance and production volume variance using the format shown in [Figure 10.13 "Fixed Manufacturing Overhead Variance Analysis for Jerry’s Ice Cream"](#). Clearly label each variance as favorable or unfavorable.

### Journalizing Direct Materials and Direct Labor Transactions

**(Appendix).** Hal's Heating produces furnaces for commercial buildings. (This is the same company as the previous exercises. This exercise can be assigned independently.)

Direct materials and direct labor variances for the month of January are shown as follows.

Materials price variance	\$(2,000) favorable
Materials quantity variance	\$ 800 unfavorable
Labor rate variance	\$ 10,000 unfavorable
Labor efficiency variance	\$(21,600) favorable

*Required:*

- a. The company purchased 1,000 elements during the month for \$38 each. Assuming a standard price of \$40 per element, prepare a journal entry to record the purchase of raw materials for the month.
- b. The company used 980 elements in production for the month, and the flexible budget shows the company expected to use 960 elements. Assuming a standard price of \$40 per element, prepare a journal entry to record the usage of raw materials in production for the month.
- c. The company used 10,000 direct labor hours during the month with an actual rate of \$19 per hour. The flexible budget shows the company expected to use 11,200 direct labor hours at a standard rate of \$18 per hour. Prepare a journal entry to record direct labor costs for the month.

**Investigating Variances.** Quality Tables, Inc., produces high-end coffee tables. Standard cost information for each table is presented as follows.



Direct materials	\$350
Direct labor	250
Variable overhead	100
Total	<u>\$700</u>

Quality Tables produced and sold 2,000 tables for the year and encountered the following production variances:

Direct materials price variance	\$ (79,000)	Favorable
Direct materials quantity variance	40,000	Unfavorable
Direct labor rate variance	97,500	Unfavorable
Direct labor efficiency variance	(35,000)	Favorable
Variable overhead spending variance	16,250	Unfavorable
Variable overhead efficiency variance	(19,000)	Favorable
Total variable production cost variance	<u>\$ 20,750</u>	Unfavorable

*Required:*

Company policy is to investigate all unfavorable variances above 10 percent of the flexible budget amount for direct materials, direct labor, and variable overhead.

- Identify the variances that should be investigated according to company policy. Show calculations to support your answer.
- What potential weakness exists in the company's current policy?

**Variance Analysis with Activity-Based Costing.** Assume Mammoth Company uses activity-based costing to allocate variable manufacturing overhead costs to products. The company identified three activities with the following information for last quarter.

Activity	Standard Rate	Standard Quantity per Unit Produced	Actual Costs	Actual Quantity
Indirect materials	\$2.40 per yard	7 yards per unit	\$691,650	265,000 yards



Product testing	\$1.50 per test minute	5 minutes per unit	\$301,000	215,000 test minutes
Indirect labor	\$4.50 per direct labor hour	4 hours per unit	\$930,000	180,000 direct labor hours

*Required:*

Assume Mammoth Company produced 40,000 units last quarter.

Prepare a variance analysis using the format shown in [Figure 10.11](#)

"[Variable Overhead Variance Analysis for Jerry's Ice Cream Using Activity-Based Costing](#)". Clearly label each variance as favorable or unfavorable.

**Closing Variance and Overhead Accounts (Appendix).** Gonzaga

Products had the following balances at the end of its fiscal year.

	Debit	Credit
Materials price variance	\$10,000	
Materials quantity variance		\$8,000
Labor rate variance		6,000
Labor efficiency variance	5,000	
Manufacturing overhead	14,000	

*Required:*

- Prepare a journal entry to close the variance and manufacturing overhead accounts. Assume the balances are not significant and thus are closed to cost of goods sold.
- Assume all products were sold and the company has no ending inventories. After making the entry in requirement a, does the balance of cost of goods sold on the income statement reflect standard costs or actual costs? Explain.



Exercises: Set B

37. **Standard Cost and Flexible Budget.** Outdoor Products, Inc., produces extreme-weather sleeping bags. The company's master budget shows the following standards information.

Expected production for September	5,000 units
Direct materials	8 yards per unit at \$5 per yard
Direct labor	3 hours per unit at \$16 per hour
Variable manufacturing overhead	3 direct labor hours per unit at \$2 per hour

38. *Required:*

- a. Calculate the standard cost per unit for direct materials, direct labor, and variable manufacturing overhead using the format shown in [Figure 10.1 "Standard Costs at Jerry's Ice Cream"](#).
- b. Assume Outdoor Products produced 5,100 sleeping bags during the month of September. Prepare a flexible budget for direct materials, direct labor, and variable manufacturing overhead using the format shown in [Figure 10.2 "Flexible Budget for Variable Production Costs at Jerry's Ice Cream"](#).

**Materials and Labor Variances.** Outdoor Products, Inc., produces extreme-weather sleeping bags. (This is the same company as the previous exercise. This exercise can be assigned independently.)

For direct materials, the standard price for 1 yard of material is \$5 per yard. A standard quantity of 8 yards of material is expected to be used for each sleeping bag produced. During September, Outdoor Products, Inc., purchased 45,000 yards of material for \$238,500 and used 39,000 yards to produce 5,100 sleeping bags.

For direct labor, Outdoor Products, Inc., established a standard number of direct labor hours at three hours per sleeping bag. The standard rate is \$16





per hour. A total of 14,700 direct labor hours were worked during September, at a cost of \$238,140, to produce 5,100 sleeping bags.

*Required:*

- a. Calculate the materials price variance and materials quantity variance using the format shown in [Figure 10.4 "Direct Materials Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.
- b. Calculate the labor rate variance and labor efficiency variance using the format shown in [Figure 10.6 "Direct Labor Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.

**Variable Overhead Variances.** Outdoor Products, Inc., produces extreme-weather sleeping bags. (This is the same company as the previous exercises. This exercise can be assigned independently.) The company applies variable manufacturing overhead at a standard rate of \$2 per direct labor hour. The standard quantity of direct labor is three hours per unit. Variable overhead costs totaled \$32,000 for the month of September. A total of 14,700 direct labor hours were worked during September to produce 5,100 sleeping bags.

*Required:*

Calculate the variable overhead spending variance and variable overhead efficiency variance using the format shown in [Figure 10.8 "Variable Manufacturing Overhead Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.

**Fixed Overhead Variance Analysis.** Outdoor Products, Inc., produces extreme-weather sleeping bags. (This is the same company as the previous exercises. This exercise can be assigned independently.) The company applies fixed manufacturing overhead costs to products based on direct labor hours. Information for the month of September appears as follows. Outdoor Products expected to produce and sell 5,000 units for the month.



Budgeted fixed overhead costs	\$135,000
Budgeted direct labor hours	÷ 15,000
Standard cost per direct labor hour	\$ 9
Standard direct labor hours per unit	3
Actual production	5,100 units
Actual fixed overhead costs	\$128,000

*Required:*

Calculate the fixed overhead spending variance and production volume variance using the format shown in [Figure 10.13 "Fixed Manufacturing Overhead Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.

#### **Journalizing Direct Materials and Direct Labor Transactions**

**(Appendix).** Outdoor Products, Inc., produces extreme-weather sleeping bags. (This is the same company as the previous exercises. This exercise can be assigned independently.)

Direct materials and direct labor variances for the month of September are shown as follows.

Materials price variance	\$13,500 unfavorable
Materials quantity variance	\$(9,000) favorable
Labor rate variance	\$ 2,940 unfavorable
Labor efficiency variance	\$(9,600) favorable

*Required:*

- The company purchased 45,000 yards of material during the month for \$5.30 per yard. Assuming a standard price of \$5 per yard, prepare a journal entry to record the purchase of raw materials for the month.
- The company used 39,000 yards of material in production for the month, and the flexible budget shows the company expected to use 40,800 yards.



Assuming a standard price of \$5 per yard, prepare a journal entry to record the usage of raw materials in production for the month.

- c. The company used 14,700 direct labor hours during the month with an actual rate of \$16.20 per hour. The flexible budget shows the company expected to use 15,300 direct labor hours at a standard rate of \$16 per hour. Prepare a journal entry to record direct labor costs for the month.

**Investigating Variances.** Tool Box, Inc., produces tool boxes sold at a variety of retail stores throughout the world. Standard cost information for each toolbox is presented as follows.

Direct materials	\$ 50
Direct labor	30
Variable overhead	40
Total	<u>\$ 120</u>

Tool Box produced and sold 100,000 toolboxes for the year and encountered the following production variances:

Direct materials price variance	\$ (300,000)	Favorable
Direct materials quantity variance	240,000	Unfavorable
Direct labor rate variance	(160,000)	Favorable
Direct labor efficiency variance	(180,000)	Favorable
Variable overhead spending variance	150,000	Unfavorable
Variable overhead efficiency variance	(210,000)	Favorable
Total variable production cost variance	<u>\$ (460,000)</u>	Favorable

*Required:*

Company policy is to investigate all unfavorable variances above 5 percent of the flexible budget amount for direct materials, direct labor, and variable overhead.

- a. Identify the variances that should be investigated according to company policy. Show calculations to support your answer.
- b. What recommendations would you make for the company's current policy?



**Variance Analysis with Activity-Based Costing.** Assume Hillside Hats, LLC, uses activity-based costing to allocate variable manufacturing overhead costs to products. The company identified three activities with the following information for last month.

Activity	Standard Rate	Standard Quantity per Unit Produced	Actual Costs	Actual Quantity
Purchase orders	\$50 per order	0.10 order per unit	\$65,000	1,600 orders
Product testing	\$2 per test minute	0.50 minutes per unit	\$17,000	8,000 test minutes
Indirect labor	\$3 per direct labor hour	1 hour per unit	\$43,000	13,000 direct labor hours

*Required:*

Assume Hillside Hats produced 15,000 units last month. Prepare a variance analysis using the format shown in [Figure 10.11 "Variable Overhead Variance Analysis for Jerry's Ice Cream Using Activity-Based Costing"](#). Clearly label each variance as favorable or unfavorable.

**Closing Variance and Overhead Accounts (Appendix).** Shasta Company had the following balances at the end of its fiscal year.

	Debit	Credit
Materials price variance		\$8,000
Materials quantity variance		2,000
Labor rate variance	\$12,000	
Labor efficiency variance		5,000

Manufacturing overhead		4,000
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*Required:*

- a. Prepare a journal entry to close the variance and manufacturing overhead accounts. Assume the balances are not significant and thus are closed to cost of goods sold.
- b. Assume all products were sold and the company has no ending inventories. After making the entry in requirement a, does the balance of cost of goods sold on the income statement reflect standard costs or actual costs? Explain.

### Problems

#### 45. Variance Analysis for Direct Materials, Direct Labor, and Variable

**Overhead.** Rain Gear, Inc., produces rain jackets. The master budget shows the following standards information and indicates the company expected to produce and sell 28,000 units for the year.

Direct materials	4 yards per unit at \$3 per yard
Direct labor	2 hours per unit at \$10 per hour
Variable manufacturing overhead	2 direct labor hours per unit at \$4 per hour

46. Rain Gear actually produced and sold 30,000 units for the year. During the year, the company purchased 130,000 yards of material for \$429,000 and used 118,000 yards in production. A total of 65,000 labor hours were worked during the year at a cost of \$637,000. Variable overhead costs totaled \$231,000 for the year.

47. *Required:*

- a. Calculate the materials price variance and materials quantity variance using the format shown in [Figure 10.4 "Direct Materials Variance Analysis"](#)



for Jerry's Ice Cream". Clearly label each variance as favorable or unfavorable.

- b. Calculate the labor rate variance and labor efficiency variance using the format shown in Figure 10.6 "Direct Labor Variance Analysis for Jerry's Ice Cream". Clearly label each variance as favorable or unfavorable.
- c. Calculate the variable overhead spending variance and variable overhead efficiency variance using the format shown in Figure 10.8 "Variable Manufacturing Overhead Variance Analysis for Jerry's Ice Cream". Clearly label each variance as favorable or unfavorable.
- d. Company policy is to investigate all variances greater than 10 percent of the flexible budget amount for each of the three variable production costs: direct materials, direct labor, and variable overhead. Identify which of the six variances calculated in requirements a through c should be investigated.
- e. Provide two possible explanations for each variance identified in requirement d.

**Fixed Overhead Variance Analysis.** (This problem is a continuation of the previous problem but can also be worked independently.) Rain Gear, Inc., produces rain jackets and applies fixed manufacturing overhead costs to products based on direct labor hours. Information for the year appears as follows. Rain Gear expected to produce and sell 28,000 units for the year.

Budgeted fixed overhead costs	\$280,000
Budgeted direct labor hours	÷ 56,000
Standard cost per direct labor hour	\$ <u>5</u>
Standard direct labor hours per unit	2
Actual production	30,000 units
Actual fixed overhead costs	\$295,000

*Required:*

- a. Calculate the fixed overhead spending variance and production volume variance using the format shown in Figure 10.13 "Fixed

**Manufacturing Overhead Variance Analysis for Jerry's Ice Cream".** Clearly label each variance as favorable or unfavorable.

- b. Company policy is to investigate all variances greater than 5 percent of the flexible budget amount. Identify whether either of the two fixed overhead variances calculated in requirement **a** should be investigated.
- c. Provide one possible explanation for variance(s) identified in requirement **b**.

### **Journalizing Direct Materials, Direct Labor, and Overhead**

**Transactions (Appendix).** Complete the following requirements for Rain Gear, Inc., using your solutions to the previous two problems.

*Required:*

- a. Prepare a journal entry to record the purchase of raw materials.
- b. Prepare a journal entry to record the use of raw materials.
- c. Prepare a journal entry to record direct labor costs.
- d. Prepare a journal entry to record actual variable and fixed manufacturing overhead expenditures.
- e. Prepare a journal entry to record variable and fixed manufacturing overhead applied to products.
- f. Based on the entries shown in requirements **a** through **e**, prepare a journal entry to transfer all work-in-process inventory costs to finished goods inventory.
- g. Assume all finished goods are sold during the period. Prepare a journal entry to transfer all finished goods inventory costs to cost of goods sold.
- h. Based on the entries shown in requirements **a** through **g**, close manufacturing overhead and all variance accounts to cost of goods sold.

**Variance Analysis for Direct Materials, Direct Labor, and Variable Overhead; Journalizing Direct Materials and Direct Labor Transactions (Includes Appendix).** Prefab Pools Company produces large prefabricated in-ground swimming pools made of a specialized plastic material. The



master budget shows the following standards information and indicates the company expected to produce and sell 600 units for the month of April.

Direct materials	500 pounds per unit at \$7 per pound
Direct labor	46 hours per unit at \$12 per hour
Variable manufacturing overhead	46 direct labor hours per unit at \$30 per hour

Prefab Pools actually produced and sold 580 units for the month. During the month, the company purchased 330,000 pounds of material for \$2,277,000 and used 295,800 pounds in production. A total of 25,520 labor hours were worked during the month at a cost of \$313,896. Variable overhead costs totaled \$790,000 for the month.

*Required:*

- a. Calculate the materials price variance and materials quantity variance using the format shown in [Figure 10.4 "Direct Materials Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.
- b. Calculate the labor rate variance and labor efficiency variance using the format shown in [Figure 10.6 "Direct Labor Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.
- c. Calculate the variable overhead spending variance and variable overhead efficiency variance using the format shown in [Figure 10.8 "Variable Manufacturing Overhead Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.
- d. Company policy is to investigate all variances at or above 2 percent of the flexible budget for direct materials and 4 percent for direct labor and variable overhead. Identify which of the six variances calculated in requirements a through c should be investigated.





- e. Provide two possible explanations for each variance identified in requirement **d**.
- f. Based on your answer to requirement **a**, prepare a journal entry to record the purchase of raw materials.
- g. Based on your answer to requirement **a**, prepare a journal entry to record the usage of raw materials.
- h. Based on your answer to requirement **b**, prepare a journal entry to record direct labor costs.

**Fixed Overhead Variance Analysis.** (This problem is a continuation of the previous problem but can be worked independently.) Prefab Pools Company produces prefabricated in-ground swimming pools and applies fixed manufacturing overhead costs to products based on direct labor hours. Information for the month of April appears as follows. Prefab Pools expected to produce and sell 600 units for the month.

Budgeted fixed overhead costs	\$966,000
Budgeted direct labor hours	+ 27,600
Standard cost per direct labor hour	<u>\$ 35</u>
Standard direct labor hours per unit	46
Actual production	580 units
Actual fixed overhead costs	\$910,000

*Required:*

- a. Calculate the fixed overhead spending variance and production volume variance using the format shown in [Figure 10.13 "Fixed Manufacturing Overhead Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.
- b. Company management has asked you to investigate the cause of the fixed overhead spending variance calculated in requirement **a**. Provide one possible explanation for this variance.

**Variance Analysis for Direct Materials, Direct Labor, Variable Overhead, and Fixed Overhead.** Equipment Products, Inc., produces large

ladders made of a specialized metal material. The master budget shows the following standards information and indicates the company expected to produce and sell 4,000 units for the month of May.

Direct materials	60 pounds per unit at \$3 per pound
Direct labor	8 hours per unit at \$14 per hour
Variable manufacturing overhead	8 direct labor hours per unit at \$6 per hour

Equipment Products actually produced and sold 4,400 units for the month. During the month, the company purchased 300,000 pounds of material for \$960,000 and used 286,000 pounds in production. A total of 30,800 labor hours were worked during the month at a cost of \$462,000. Variable overhead costs totaled \$195,000 for the month.

With regards to fixed manufacturing overhead, the company also applies these overhead costs to products based on direct labor hours. Fixed manufacturing overhead information for the month of May appears as follows.

Budgeted fixed overhead costs	\$ 864,000
Budgeted direct labor hours	= 32,000
Standard cost per direct labor hour	<u>\$ 27</u>
Actual fixed overhead costs for May	<u>\$ 990,000</u>

*Required:*

- Calculate the materials price variance and materials quantity variance using the format shown in [Figure 10.4 "Direct Materials Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.
- Calculate the labor rate variance and labor efficiency variance using the format shown in [Figure 10.6 "Direct Labor Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.



- c. Calculate the variable overhead spending variance and variable overhead efficiency variance using the format shown in [Figure 10.8 "Variable Manufacturing Overhead Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.
- d. Company policy is to investigate all variances greater than 10 percent of the flexible budget amount for each of the 3 variable production costs: direct materials, direct labor, and variable overhead. Identify which of the six variances calculated in requirements **a** through **c** should be investigated.
- e. Provide two possible explanations for each variance identified in requirement **d**.
- f. Calculate the fixed overhead spending variance and production volume variance using the format shown in [Figure 10.13 "Fixed Manufacturing Overhead Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.

#### **Journalizing Direct Labor and Overhead Transactions**

**(Appendix).** Complete the following requirements for Equipment Products, Inc., using your solutions to the previous problem.

*Required:*

- a. Prepare a journal entry to record direct labor costs.
- b. Prepare a journal entry to record actual variable and fixed manufacturing overhead expenditures.
- c. Prepare a journal entry to record variable and fixed manufacturing overhead applied to products.

**Variance Analysis with Activity-Based Costing.** Assume Spindle Company uses activity-based costing to allocate variable manufacturing overhead costs to products. The company identified three activities with the following information for last quarter.

Activity	Standard Rate	Standard Quantity per Unit Produced	Actual Costs	Actual Quantity



Indirect materials	\$5 per yard	14 yards per unit	\$4,850,000	990,000 yards
Product testing	\$3 per test minute	10 minutes per unit	\$2,000,000	650,000 test minutes
Indirect labor	\$9 per direct labor hour	6 hours per unit	\$3,800,000	410,000 direct labor hours

*Required:*

- a. Assume Spindle Company produced 70,000 units last quarter. Prepare a variance analysis using the format shown in [Figure 10.11 "Variable Overhead Variance Analysis for Jerry's Ice Cream Using Activity-Based Costing"](#). Clearly label each variance as favorable or unfavorable.
- b. Company policy is to investigate all variances above 5 percent of the flexible budget amount for each activity. Identify the variances that should be investigated according to company policy. Show calculations to support your answer.

#### One Step Further: Skill-Building Cases

53. **Variance Analysis and Fraud.** Refer to [Note 10.47 "Business in Action 10.4"](#) and to [Note 10.52 "Business in Action 10.5"](#) Explain how cost variance analysis might help detect fraud.

54. **Group Activity: Setting Standards.** Form groups of two to four students.

Each group is to complete the following requirements.

*Required:*

- a. Define and discuss the differences between ideal standards and attainable standards.
- b. Assume your group works for a company that produces wood desks and you are in the process of creating attainable direct material and direct labor standards. Provide specific examples of the items that might be included in



(1) the standard quantity and standard price for direct materials and (2) the standard hours and standard rate for direct labor. Explain where this information might be obtained, and identify specific production inefficiencies your group included in creating these standards that would not be included in ideal standards.

- c. Discuss the findings of your group with the class. (Optional: your instructor may ask you to submit your findings in writing.)

**Internet Project: Standard Costs and Cost Variances. Systems Applications and Products (SAP)** is the world's largest business software company with 38,000 customers worldwide. Go to the **SAP** Web site at <http://www.sap.com> and find the search feature. Type in "standard costing" or "cost variance" and find an article that discusses standard costs and/or cost variances (there are several articles to choose from). Summarize the article in a one-page report, and submit a printed copy of the article with your report.

**Ethics and Setting Standards.** Wilkes Golf, Inc., produces golf carts that are sold throughout the world. The company's management is in the process of establishing the standard hours of direct labor required to complete one golf cart. Assume you are the production supervisor, and you receive a bonus for each quarter that shows a favorable labor efficiency variance. That is, you receive a bonus for each quarter showing actual direct labor hours that are fewer than budgeted direct labor hours.

The management has asked for your input in establishing the standard number of direct labor hours required to complete one golf cart.

*Required:*

- a. As the production supervisor, describe the ethical conflict you face when asked to help with establishing direct labor hour standards.
- b. How might the management of Wilkes Golf, Inc., avoid this conflict and still achieve the goal of obtaining reliable direct labor hour information?

**Using Excel to Perform Budget Versus Actual Analysis.** The management of Home Products, Inc., prepared the following budgeted income statement for the year ending December 31, 2012.

	A	B	C
1	<b>Home Products, Inc.</b>		
2	<b>Budgeted Income Statement</b>		
3	<b>Year Ending December 31, 2012</b>		
4			
5		<b>Budget</b>	
6	Sales	\$ 3,600,000	
7	Variable cost of goods sold	1,600,000	
8	Variable selling and administrative expenses	480,000	
9	Contribution margin	\$ 1,520,000	
10	Fixed cost of goods sold	1,160,000	
11	Fixed selling and administrative expenses	240,000	
12	Net profit	\$ 120,000	
13			

At the end of 2012, the company prepared the following income statement showing actual results:

	A	B	C
1	<b>Home Products, Inc.</b>		
2	<b>Income Statement</b>		
3	<b>Year Ending December 31, 2012</b>		
4			
5		<b>Actual Results</b>	
6	Sales	\$ 3,610,000	
7	Variable cost of goods sold	1,736,000	
8	Variable selling and administrative expenses	500,000	
9	Contribution margin	\$ 1,374,000	
10	Fixed cost of goods sold	990,000	
11	Fixed selling and administrative expenses	255,000	
12	Net profit	\$ 129,000	
13			

*Required:*

Prepare an Excel spreadsheet comparing the actual results to budgeted amounts using the format shown as follows, and comment on the results.

Home Products, Inc.				
Income Statement Variance Analysis				
Year Ending December 31, 2012				
	Actual	Budget	Variance	(Favorable) Unfavorable
Sales				
Variable cost of goods sold				
Variable selling and administrative expenses				
Contribution margin				
Fixed cost of goods sold				
Fixed selling and administrative expenses				
Net profit				

### Comprehensive Cases

**58. Variable Production Cost Variance Analysis.** Iron Products, Inc., produces prefabricated iron fencing used in commercial construction. Variable overhead is applied to products based on direct labor hours. The company uses a just-in-time production system and thus has insignificant inventory levels at the end of each month. The income statement for the month of November comparing actual results with the flexible budget based on actual sales of 2,000 units is shown as follows.

Iron Products, Inc. Income Statement (budget versus actual)				
	Actual	Budget	Variance	
Sales	\$ 1,805,000	\$ 1,800,000	\$ (5,000)	Favorable
Variable cost of goods sold	867,400	800,000	67,400	Unfavorable
Variable selling and administrative expenses	250,000	240,000	10,000	Unfavorable
Contribution margin	687,600	760,000	72,400	Unfavorable
Fixed cost of goods sold	575,000	580,000	(5,000)	Favorable
Fixed selling and administrative expenses	117,000	120,000	(3,000)	Favorable
Net profit	\$ (4,400)	\$ 60,000	\$ 64,000	Unfavorable

Iron Products is disappointed with the actual results and has hired you as a consultant to provide further information as to why the company has been

struggling to meet budgeted net profit. Your review of the previously presented budget versus actual analysis identifies variable cost of goods sold as the main culprit. The unfavorable variance for this line item is \$67,400.

After further research, you are able to track down the following standard cost information for variable production costs:

	<b>Standard Cost per Unit</b>
Direct materials (50 pounds per unit at \$5 per pound)	\$250
Direct labor (3 hours at \$20 per hour)	60
Variable overhead (3 direct labor hours at \$30 per hour)	90
Standard variable production cost per unit	<u>\$400</u>

Actual production information related to variable cost of goods sold for the month of November is as follows:

- o 2,000 units were produced and sold.
- o 110,000 pounds of material were purchased and used at a total cost of \$528,000.
- o 5,600 direct labor hours were used during the month at a total cost of \$134,400.
- o Variable overhead costs totaled \$205,000.

*Required:*

- e. Calculate the materials price variance and materials quantity variance using the format shown in [Figure 10.4 "Direct Materials Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.
- f. Calculate the labor rate variance and labor efficiency variance using the format shown in [Figure 10.6 "Direct Labor Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.



- g. Calculate the variable overhead spending variance and variable overhead efficiency variance using the format shown in Figure 10.8 "Variable Manufacturing Overhead Variance Analysis for Jerry's Ice Cream". Clearly label each variance as favorable or unfavorable.
- h. List each of the six variances calculated in requirements a, b, and c, and total the variances to show one net variance. Clearly label the net variance as favorable or unfavorable. Explain how this net variance relates to variable cost of goods sold on the income statement.
- i. Identify the highest favorable variance and highest unfavorable variance from the six listed in requirement d, and provide one possible cause of each variance.

### Variable Production Cost Variance Analysis and Performance

**Evaluation.** Fast Sleds, Inc., produces snow sleds used for winter recreation. Variable overhead is applied to products based on machine hours. The company uses a just-in-time production system, and thus has insignificant inventory levels at the end of each month. The income statement for the month of January comparing actual results with the flexible budget is shown in the following based on actual sales of 10,000 units.

Fast Sleds, Inc. Income Statement (budget versus actual)				
	Actual	Budget	Variance	
Sales	\$ 305,000	\$ 300,000	\$ (5,000)	Favorable
Variable cost of goods sold	108,700	100,000	8,700	Unfavorable
Variable selling and administrative expenses	76,000	70,000	6,000	Unfavorable
Contribution margin	120,300	130,000	9,700	Unfavorable
Fixed cost of goods sold	53,000	55,000	(2,000)	Favorable
Fixed selling and administrative expenses	38,000	35,000	3,000	Unfavorable
Net profit	\$ 29,300	\$ 40,000	\$ 10,700	Unfavorable



Fast Sleds is disappointed with the actual results and has hired you as a consultant to provide further information as to why the company has been struggling to meet budgeted net income. Your review of the budget presented previously versus actual analysis identifies variable cost of goods sold as the main culprit. The unfavorable variance for this line item is \$8,700.

After further research, you are able to track down the standard cost information for variable production costs:

	Standard Cost per Unit
Direct materials (12 pounds per unit at \$0.50 per pound)	\$ 6
Direct labor (0.20 hours at \$15 per hour)	3
Variable overhead (0.10 direct labor hours at \$10 per hour)	1
Standard variable production cost per unit	<u>\$ 10</u>

Actual production information related to variable cost of goods sold for the month of January is as follows:

- o 10,000 units were produced and sold.
- o 150,000 pounds of material was purchased and used at a total cost of \$67,500.
- o 1,900 direct labor hours were used during the month at a total cost of \$30,400.
- o 1,200 machine hours were used during the month.
- o Variable overhead costs totaled \$10,800.

*Required:*

- f. Calculate the materials price variance and materials quantity variance using the format shown in [Figure 10.4 "Direct Materials Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.

- g. Calculate the labor rate variance and labor efficiency variance using the format shown in [Figure 10.6 "Direct Labor Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.
- h. Calculate the variable overhead spending variance and variable overhead efficiency variance using the format shown in [Figure 10.8 "Variable Manufacturing Overhead Variance Analysis for Jerry's Ice Cream"](#). Clearly label each variance as favorable or unfavorable.
- i. List each of the six variances calculated in requirements **a**, **b**, and **c**, and total the variances to show one net variance. Clearly label the net variance as favorable or unfavorable. Explain how this net variance relates to variable cost of goods sold on the income statement.
- j. Identify the highest favorable variance and highest unfavorable variance from the six listed in requirement **d**, and provide one possible cause of each variance.
- k. Sue Mays, the manager at Fast Sleds, Inc., reviewed the company's variance analysis report for the month of January. The materials price variance of \$(7,500) was the most significant favorable variance for the month, and the materials quantity variance of \$15,000 was the most significant unfavorable variance. Sue would like to reward the company's purchasing agent for achieving such substantial savings by giving him a \$2,000 bonus while not providing any bonus for the production manager.
12. Do you agree with Sue's approach to awarding bonuses? Explain.
13. What circumstances might lead to the conclusion that the purchasing agent should not receive a bonus for the month of January?

