**FINANCIAL ACCOUNTING II**

**CHAPTER FOUR**

**DEPRECIATION, IMPAIRMENTS, AND DEPLETION**

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**DEPRECIATION—A METHOD OF COST ALLOCATION**

Most individuals at one time or another purchase and trade in an automobile. The automobile dealer and the buyer typically discuss what the trade-in value of the old car is. Also, they may talk about what the trade-in value of the new car will be in several years. In both cases a decline in value is considered to be an example of depreciation.

To accountants, however, depreciation is not a matter of valuation. Rather, depreciation is a means of cost allocation.

**Depreciation is the accounting process of allocating the cost of tangible assets to expense in a systematic and rational manner to those periods expected to benefit from the use of the asset.** Companies do not depreciate assets on the basis of a decline in their fair market value. Instead, they depreciate through systematic charges to expense. This approach is employed because the value of the asset may fluctuate between the time the asset is purchased and the time it is sold or junked. Attempts to measure these interim value changes have not been well received because values are difficult to measure objectively. Therefore, companies charge the asset’s cost to depreciation expense over its estimated life. They make no attempt to value the asset at fair market value between acquisition and disposition. Companies use the cost allocation approach because it matches costs with revenues and because fluctuations in market value around certain and difficult to measure.

When companies write off the cost of long-lived assets over a number of periods, they typically use the term **depreciation**. They use the term **depletion** to describe the reduction in the cost of natural resources (such as timber, gravel, oil, and coal) over a period of time. The expiration of intangible assets, such as patents or copyrights, is called **amortization**.

**Factors Involved in the Depreciation Process**

Before establishing a pattern of charges to revenue, a company must answer three basic questions:

**1.** What depreciable base is to be used for the asset?

**2.** What is the asset’s useful life?

**3.** What method of cost apportionment is best for this asset?

The answers to these questions involve combining several estimates into one single figure. Note the calculations assume perfect knowledge of the future, which is never attainable.

**Depreciable Base for the Asset**

The base established for depreciation is a function of two factors: the original cost, and salvage or disposal value. We discussed historical cost in Chapter 3. **Salvage value** is the estimated amount that a company will receive when it sells the asset or removes it from service. It is the amount to which a company writes down or depreciates the asset during its useful life. If an asset has a cost of $10,000 and salvage value of $1,000,its **depreciation base** is $9,000 computed as follows:

Original cost $10,000

Less: Salvage value 1,000

Depreciation base **$ 9,000**

From a practical standpoint, companies often assign a zero salvage value. Some long-lived assets, however, have substantial salvage values.

**Estimation of Service Lives**

The service life of an asset often differs from its physical life. A piece of machinery maybe physically capable of producing a given product for many years beyond its service life. But a company may not use the equipment for all that time because the cost of producing the product in later years may be too high.

Companies retire assets for two reasons: **physical factors** (such as casualty or expiration of physical life) and **economic factors** (obsolescence). Physical factors are the wear and tear, decay, and casualties that make it difficult for the asset to perform indefinitely. These physical factors set the outside limit for the service life of an asset.

We can classify the economic or functional factors into three categories:

1. **Inadequacy** results when an asset ceases to be useful to a company because the demands of the firm have changed. An example would be the need for a larger building to handle increased production. Although the old building may still be sound, it may have become inadequate for the company’s purpose.
2. **Supersession** is the replacement of one asset with another more efficient and economical asset. Examples would be the replacement of the mainframe computer with a PC network, or the replacement of the Boeing 767 with the Boeing 787.
3. **Obsolescence** is the catchall for situations not involving inadequacy and supersession.

Because the distinction between these categories appears artificial, it is probably best to consider economic factors collectively instead of trying to make distinctions that are not clear-cut.

To illustrate the concepts of physical and economic factors, consider a new nuclear power plant. Which is more important in determining the useful life of a nuclear power plant—physical factors or economic factors? The limiting factors seem to be(1) Ecological considerations, (2) competition from other power sources, and (3) safety concerns.

Physical life does not appear to be the primary factor affecting useful life. Although the plant’s physical life may be far from over, the plant may become obsolete in 10 years.

For a house, physical factors undoubtedly are more important than the economic or functional factors relative to useful life. Whenever the physical nature of the asset primarily determines useful life, maintenance plays an extremely vital role. The better the maintenance, the longer the life of the asset.

In most cases, a company estimates the useful life of an asset based on its past experience with the same or similar assets. Others use sophisticated statistical methods to establish a useful life for accounting purposes. And in some cases, companies select arbitrary service lives. In a highly industrial economy, where research and innovation are so prominent, technological factors have as much effect, if not more, on service lives of tangible plant assets as physical factors do.

**Methods of Depreciation**

The third factor involved in the depreciation process is the **method** of cost apportionment. The profession requires that the depreciation method employed be “systematic and rational.” Companies may use a number of depreciation methods, as follows.

1. Activity method (units of use or production).
2. Straight-line method.
3. Decreasing charge methods (accelerated):

**(a)** Sum-of-the-years’-digits.

**(b)** Declining-balance method.

1. Special depreciation methods:

**(a)** Group and composite methods.

**(b)** Hybrid or combination methods.

To illustrate these depreciation methods, assume that Stanley Coal Mines recently purchased an additional crane for digging purposes. Following is pertinent data concerning this purchase.

Cost of crane $500,000

Estimated useful life 5 years

Estimated salvage value $ 50,000

Productive life in hours 30,000 hours

1. **Activity Method**

The **activity method** (also called the **variable-charge** or **units-of-production approach**) assumes that depreciation is **a function of use or productivity, instead of the passage of time**. A company considers the life of the asset in terms of either the **output** it provides (units it produces), or an **input** measure such as the number of hours it works. Conceptually, the proper cost association relies on output instead of hours used, but often the output is not easily measurable. In such cases, an input measure such as machine hours is a more appropriate method of measuring the dollar amount of depreciation charges for a given accounting period. The crane poses no particular depreciation problem. Stanley can measure the usage (hours) relatively easily. If Stanley uses the crane for 4,000 hours the first year, the depreciation charge is:



The major limitation of this method is that it is inappropriate in situations in which depreciation is a function of time instead of activity. For example, a building steadily deteriorates due to the elements (time) regardless of its use. In addition, where economic or functional factors affect an asset, independent of its use, the activity method loses much of its significance. For example, if a company is expanding rapidly, a particular building may soon become obsolete for its intended purposes. In both cases, activity is irrelevant. Another problem in using an activity method is the difficulty of estimating units of output or service hours received.

In cases where loss of services results from activity or productivity, the activity method matches costs and revenues the best. Companies that desire low depreciation during periods of low productivity, and high depreciation during high productivity, either adopt or switch to an activity method. In this way, a plant running at 40 percent of capacity generates 60 percent lower depreciation charges. For example, a company in USA (**Inland Steel)**switched to units-of-production depreciation at one time and reduced its losses by$43 million, or $1.20 per share.

1. **Straight-Line Method**

The **straight-line method** considers depreciation a **function of time rather than a function of usage**. Companies widely use this method because of its simplicity. The straight-line procedure is often the most conceptually appropriate, too. When creeping obsolescence is the primary reason for a limited service life, the decline in usefulness may be constant from period to period. Stanley computes the depreciation charge for the crane as follows.

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The major objection to the straight-line method is that it rests on two tenuous assumptions:

(1) The asset’s economic usefulness is the same each year, and

(2) The repair and maintenance expense is essentially the same each period.

One additional problem that occurs in using straight-line—as well as some others—is that distortions in the rate of return analysis (income/assets) develop.

The following computation indicates how the rate of return increases, given constant revenueflows, because the asset’s book value decreases.

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1. **Decreasing-Charge Methods**

The **decreasing-charge methods** provide for a higher depreciation cost in the earlier years and lower charges in later periods. Because these methods allow for higher early-year charges than in the straight-line method, they are often called **accelerated depreciation methods**.

What is the main justification for this approach? The rationale is that companies should charge more depreciation in earlier years because the asset is most productive in its earlier years. Furthermore, the accelerated methods provide a constant cost because the depreciation charge is lower in the later periods, at the time when the repair and maintenance costs are often higher. Generally, companies use one of two decreasing-charge methods: the sum-of-the-years’-digits method, or the declining-balance method.

* 1. ***Sum-of-the-Years’-Digits.*** The **sum-of-the-years’-digits method** results in a decreasing depreciation charge based on a decreasing fraction of depreciable cost (original costless salvage value). Each fraction uses the sum of the years as a denominator (5+4+3+2+1 =15). The numerator is the number of years of estimated life remaining as of the beginning of the year. In this method, the numerator decreases year by year, and the denominator remains constant (5/15, 4/15, 3/15, 2/15, and 1/15). At the end of the asset’s useful life, the balance remaining should equal the salvage value.

The following table shows this method of computation.

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**What happens if the estimated service life of the asset is, let us say, 51 years? How would we calculate the sum-of-the-years’-digits? Fortunately mathematicians have developed the following formula that permits easy computation:**

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* 1. ***Declining-Balance Method.*** The **declining-balance method** utilizes a depreciation rate (expressed as a percentage) that is some multiple of the straight-line method. For example, the double-declining rate for a 10-year asset is 20 percent (double the straight line rate, which is 1/10 or 10 percent). Companies apply the constant rate to the declining book value each year.

Unlike other methods, the declining-balance method **does not deduct the salvage value** in computing the depreciation base. The declining-balance rate is multiplied by the book value of the asset at the beginning of each period. Since the depreciation charge reduces the book value of the asset each period, applying the constant-declining balance rate to a successively lower book value results in lower depreciation charges each year. This process continues until the book value of the asset equals its estimated salvage value. At that time the company discontinues depreciation.

Companies use various multiples in practice. For example, the **double-declining balance method** depreciates assets at twice (200 percent) the straight-line rate. The following table shows Stanley’s depreciation charges if using the double-declining approach.

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Companies often switch from the declining-balance method to the straight-line method near the end of the asset’s useful life to ensure that they depreciate the asset only to its salvage value.

**A pure form of the declining-balance method (sometimes appropriately called the “fixed percentage of book value method”) has also been suggested as a possibility. This approach finds a rate that depreciates the asset exactly to salvage value at the end of its expected useful life. The formula for determination of this rate is as follows:**



**The life in years is *n.* After computing the depreciation rate, a company applies it on the declining book value of the asset from period to period, which means that depreciation expense will be successively lower. This method is not used extensively in practice due to cumbersome computations. Further, it is not permitted for tax purposes.**

**Special Depreciation Methods**

Sometimes companies adopt special depreciation methods. Reasons for doing so might be that a company’s assets have unique characteristics, or the nature of the industry. Two of these special methods are:

**1.** Group and composite methods.

**2.** Hybrid or combination methods.

**Group and Composite Methods**

Companies often depreciate multiple-asset accounts using one rate. Two methods of depreciating multiple-asset accounts exist: the group method and the composite method. The choice of method depends on the nature of the assets involved.

Companies frequently use the **group method** when the assets are similar in nature and have approximately the same useful lives. They use the **composite approach** when the assets are dissimilar and have different lives. The group method more closely approximates a single-unit cost procedure because the dispersion from the average is not as great. The computation for group or composite methods is essentially the same: find an average and depreciate on that basis.

Companies determine the **composite depreciation rate** by dividing the depreciation per year by the total cost of the assets. To illustrate, Mooney Motors establishes the composite depreciation rate for its fleet of cars, trucks, and campers as shown in the following Illustration.

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If there are no changes in the asset account, Mooney will depreciate the group of assets to the residual or salvage value at the rate of $56,000 ($224,000 x25%) a year. As a result, it will take Mooney 3.39 years to depreciate these assets. The length of time it takes a company to depreciate it assets on a composite basis is called the **composite life**.

We can highlight the differences between the group or composite method and the single-unit depreciation method by looking at asset retirements. If Mooney retires an asset before, or after, the average service life of the group is reached, it buries the resulting gain or loss in the Accumulated Depreciation account. This practice is justified because Mooney will retire some assets before the average service life and others after the average life. For this reason, the debit to Accumulated Depreciation is the difference between original cost and cash received. Mooney does not record a gain or loss on disposition.

To illustrate, suppose that Mooney Motors sold one of the campers with a cost of$5,000 for $2,600 at the end of the third year. The entry is:

 Accumulated Depreciation 2,400

 Cash 2,600

 Cars, Trucks, and Campers 5,000

If Mooney purchases a new type of asset (mopeds, for example), it must compute a new depreciation rate and apply this rate in subsequent periods.

The following excerpt presents a typical financial statement disclosure of the group depreciation method for **Ampco-Pittsburgh Corporation**.

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The group or composite method simplifies the bookkeeping process and tends to average out errors caused by over- or under depreciation. As a result, gains or losses on disposals of assets do not distort periodic income.

On the other hand, the unit method has several advantages over the group or composite methods: (1) it simplifies the computation mathematically. (2) It identifies gains and losses on disposal. (3) It isolates depreciation on idle equipment. (4) It represents the best estimate of the depreciation of each asset, not the result of averaging the cost over a longer period of time. As a consequence, companies generally use the unit method.

**Hybrid or Combination Methods**

In addition to the depreciation methods already discussed, companies are free to develop their own special or tailor-made depreciation methods. GAAP requires only that the method result in the allocation of an asset’s cost over the asset’s life in a **systematic and rational manner**.

For example, the steel industry widely uses a hybrid depreciation method, called the **production variable method**, that is a combination straight-line/activity approach. The following note from **WHX Corporation**’s annual report explains one variation of this method.

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**Special Depreciation Issues**

We still need to discuss several special issues related to depreciation:

**1.** How should companies compute depreciation for partial periods?

**2.** Does depreciation provide for the replacement of assets?

**3.** How should companies handle revisions in depreciation rates?

**Depreciation and Partial Periods**

Companies seldom purchase plant assets on the first day of a fiscal period or dispose of them on the last day of a fiscal period. A practical question is: How much depreciation should a company charge for the partial periods involved?

In computing depreciation expense for partial periods, companies must determine the depreciation expense for the full year and then prorate this depreciation expense between the two periods involved. This process should continue throughout the useful life of the asset.

Assume, for example, that Steeltex Company purchases an automated drill machine with a 5-year life for $45,000 (no salvage value) on June 10, 2009. The company’s fiscally ear ends December 31. Steeltex therefore charges depreciation for only 62⁄3 months during that year. The total depreciation for a full year (assuming straight-line depreciation)is $9,000 ($45,000/5). The depreciation for the first, partial year is therefore:

 

The partial-period calculation is relatively simple when Steeltex uses straight-line depreciation. But how is partial-period depreciation handled when it uses an accelerated method such as sum-of-the-years’-digits or double-declining-balance?

As an illustration, assume that Steeltex purchased another machine for $10,000 on July 1, 2009,with an estimated useful life of five years and no salvage value. The following computation showsthe depreciation figures for 2009, 2010, and 2011.

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Sometimes a company like Steeltex modifies the process of allocating costs to a partial period to handle acquisitions and disposals of plant assets more simply. One variation is to take no depreciation in the year of acquisition and a full year’s depreciation in the year of disposal. Other variations charge one-half year’s depreciation both in the year of acquisition and in the year of disposal (referred to as the **half year convention**), or charge a full year in the year of acquisition and none in the year of disposal.

In fact, Steeltex may adopt any one of these several fractional-year policies in allocating cost to the first and last years of an asset’s life so long as it applies the method consistently. However, **unless otherwise stipulated, companies normally compute depreciation on the basis of the nearest full month**.

The following illustration shows depreciation allocated under five different fractional-year policies using the straight-line method on the $45,000 automated drill machine purchased by Steeltex Company on June 10, 2009, discussed earlier.

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**Depreciation and Replacement of Fixed Assets**

A common misconception about depreciation is that it provides funds for the replacement of fixed assets. Depreciation is like other expenses in that it reduces net income. It differs, though, in that **it does not involve a current cash outflow**.

To illustrate why depreciation does not provide funds for replacement of plant assets, assume that a business starts operating with plant assets of $500,000 that have a useful life of five years. The company’s balance sheet at the beginning of the period is:

Plant assets $500,000 Stockholders’ equity $500,000

If we assume that the company earns no revenue over the five years, the income statements are:



Total depreciation of the plant assets over the five years is $500,000. The balance sheet at the end of the five years therefore is:



This extreme example illustrates that depreciation **in no way** provides funds for the replacement of assets. **The funds for the replacement of the assets come from therevenues** (generated through use of the asset). Without the revenues, no income materializes and no cash inflow results.

**Revision of Depreciation Rates**

When purchasing a plant asset, companies carefully determine depreciation rates based on past experience with similar assets and other pertinent information. The provisions for depreciation are only estimates, however. They may need to revise them during the life of the asset. Unexpected physical deterioration or unforeseen obsolescence may decrease the estimated useful life of the asset. Improved maintenance procedures, revision of operating procedures, or similar developments may prolong the life of the asset beyond the expected period.

For example, assume that **International Paper Co.** purchased machinery with an original cost of $90,000. It estimates a 20-year life with no salvage value. However, during year 11, International Paper estimates that it will use the machine for an additional 20 years. Its total life, therefore, will be 30 years instead of 20. Depreciation has been recorded at the rate of 1/20 of $90,000, or $4,500 per year by the straight-line method.

On the basis of a 30-year life, International Paper should have recorded depreciation as 1/30 of $90,000, or $3,000 per year. It has therefore overstated depreciation, and understated net income, by $1,500 for each of the past 10 years, or a total amount of $15,000. The following table shows this computation.

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**International Paper should report this change in estimate in the current and prospective periods.** It should not make any changes in previously reported results. And it does not adjust opening balances nor attempt to “catch up” for prior periods. The reason? Changes in estimates are a continual and inherent part of any estimation process. Continual restatement of prior periods would occur for revisions of estimates unless handled prospectively. Therefore, no entry is made at the time the change in estimate occurs. Charges for depreciation in subsequent periods (assuming use of the straight-line method) are determined by **dividing the remaining book value less any salvage value by the remaining estimated life** as computed below:

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The entry to record depreciation for each of the remaining 20 years is:

 Depreciation Expense 2,250

 Accumulated Depreciation—Machinery 2,250

**IMPAIRMENTS**

The general accounting standard of **lower-of-cost-or-market for inventories does not apply to property**, **plant**, **and equipment**. Even when property, plant, and equipment has suffered partial obsolescence, accountants have been reluctant to reduce the asset’s carrying amount. Why? Because, unlike inventories, it is difficult to arrive at a fair value for property, plant, and equipment that is not subjective and arbitrary.

For example, **Falconbridge Ltd. Nickel Mines** had to decide whether to write off all or a part of its property, plant, and equipment in a nickel-mining operation in the Dominican Republic. The project had been incurring losses because nickel prices were low and operating costs were high. Only if nickel prices increased by approximately 33 percent would the project be reasonably profitable.

Whether a write-off was appropriate depended on the future price of nickel. Even if the company decided to write off the asset, how much should be written off?

**Recognizing Impairments**

The FASB and international accounting standard setters have developed rules for recognizing impairments on long-lived assets. According to these standards, when the carrying amount of an asset is not recoverable, a company records a write-off. This write-off is referred to as an impairment.

Various events and changes in circumstances might lead to an impairment. Examples are:

1. A significant decrease in the market value of an asset.
2. A significant change in the extent or manner in which an asset is used.
3. A significant adverse change in legal factors or in the business climate that affects the value of an asset.
4. An accumulation of costs significantly in excess of the amount originally expected to acquire or construct an asset.
5. A projection or forecast that demonstrates continuing losses associated with an asset.

These events or changes in circumstances indicate that the company may not be able to recover the carrying amount of the asset. In that case, a **recoverability test** is used to determine whether an impairment has occurred.

To apply the first step of the recoverability test, a company estimates the future net cash flows expected from the **use of that asset and its eventual disposition**.

If the sum of the expected future net cash flows (undiscounted) is **less than the carrying amount** of the asset, UPS considers the asset impaired. Conversely, if the sum of the expected future net cash flows (undiscounted) is **equal to or greater than the carrying amount** of the asset, no impairment has occurred.

The recoverability test therefore screens for asset impairment. For example, if the expected future net cash flows from an asset are $400,000 and its carrying amount is

$350,000, no impairment has occurred. However, if the expected future net cash flows are $300,000, an impairment has occurred. The rationale for the recoverability test relies on a basic presumption: A balance sheet should report long-lived assets at no more than the carrying amounts that are recoverable.

**Measuring Impairments**

If the recoverability test indicates an impairment, the company computes a loss. The **impairment loss** is the amount by which the carrying amount of the asset **exceeds its fair value**. How does the company determine the fair value of an asset? It is measured based on themarket value if an active market for the asset exists. If no active market exists, the companyuses the **present value of expected future net cash flows to determine fair value**.

To summarize, the process of determining an impairment loss is as follows.

1. Review events or changes in circumstances for possible impairment.
2. If the review indicates impairment, apply the recoverability test. If the sum of the expected future net cash flows from the long-lived asset is less than the carrying amount of the asset, an impairment has occurred.
3. Assuming an impairment, the impairment loss is the amount by which the carrying amount of the asset exceeds the fair value of the asset. The fair value is the market value or the present value of expected future net cash flows.

**Impairment—Example 1**

M. Alou Inc. has an asset that, due to changes in its use, it reviews for possible impairment. The asset’s carrying amount is $600,000 ($800,000 cost less $200,000 accumulated depreciation). Alou determines the expected future net cash flows (undiscounted) from the use of the asset and its eventual disposal to be $650,000.

The recoverability test indicates that the $650,000 of expected future net cash flows from the asset’s use exceed the carrying amount of $600,000.

As a result, no impairment occurred. (Recall that the undiscounted future net cash flows must be less than the carrying amount for Alou to deem an asset to be impaired and to measure the impairment loss.) Therefore, M. Alou Inc. does not recognize an impairment loss in this case.

**Impairment—Example 2**

Assume the same facts as in Example 1, except that the expected future net cash flows from Alou’s asset are $580,000 (instead of $650,000). The recoverability test indicates that the expected future net cash flows of $580,000 from the use of the asset are less than its carrying amount of $600,000. Therefore an impairment has occurred. The difference between the carrying amount of Alou’s asset and its fair value is the impairment loss. Assuming this asset has a market value of $525,000, the following table shows the loss computation

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M. Alou records the impairment loss as follows.

 Loss on Impairment 75,000

 Accumulated Depreciation 75,000

M. Alou Inc. reports the impairment loss as part of income from continuing operations, in the “Other expenses and losses” section. Generally, Alou **should not report this lossas an extraordinary item**. Costs associated with an impairment loss are the same costs that would flow through operations and that it would report as part of continuing operations.

Alou will continue to use these assets in operations. Therefore, it should not report the loss below “Income from continuing operations.”A company that recognizes an impairment loss should disclose the asset(s) impaired, the events leading to the impairment, the amount of the loss, and how it determined fair value (disclosing the interest rate used, if appropriate).

**Restoration of Impairment Loss**

After recording an impairment loss, the reduced carrying amount of an asset held for use becomes its new cost basis. A company does not change the new cost basis except for depreciation or amortization in future periods or for additional impairments.

To illustrate, assume that Damon Company at December 31, 2009, has equipment with a carrying amount of $500,000. Damon determines this asset is impaired and writes it down to its fair value of $400,000. At the end of 2010, Damon determines that the fair value of the asset is $480,000. The carrying amount of the equipment should not change in 2010 except for the depreciation taken in 2010. Damon **may not restore animpairment loss for an asset held for use**. The rationale for not writing the asset up in value is that the new cost basis puts the impaired asset on an equal basis with other assets that are unimpaired.

**Impairment of Assets to Be Disposed Of**

What happens if a company intends to dispose of the impaired asset, instead of holding it for use? Recently **Kroger** recorded an impairment loss of $54 million on property, plant, and equipment it no longer needed due to store closures. In this case, Kroger reports the impaired asset at the lower of cost or net realizable value(fair value less cost to sell).

Because Kroger intends to dispose of the assets in a short period of time, it uses net realizable value in order to provide a better measure of the net cash flows that it will receive from these assets.

Kroger does not depreciate or amortize assets held for disposal during the period it holds them. The rationale is that depreciation is inconsistent with the notion of assets to be disposed of and with the use of the lower of cost or net realizable value. In other words, **assets held for disposal are like inventory**; **companies should report them at the lower of cost or net realizable value**. Because Kroger will recover assets held for disposal through sale rather than through operations, it continually revalues them. Each period, the assets are reported at the lower of cost or net realizable value. Thus **Kroger can write up or down an asset held for disposal in future periods, as long as the carrying value after the write-up never exceeds the carrying amount of the asset before the impairment**. Companies should report losses or gains related to these impaired assets as part of **income from continuing operations**.

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**DEPLETION**

**Natural resources**, often called wasting assets, include petroleum, minerals, and timber. They have two main features: (1) the complete removal (consumption) of the asset, and

(2) Replacement of the asset only by an act of nature. Unlike plant and equipment, natural resources are consumed physically over the period of use and do not maintain their physical characteristics. Still, the accounting problems associated with natural resources are similar to those encountered with fixed assets.

The questions to be answered are:

**1.** How do companies establish the cost basis for write-off?

**2.** What pattern of allocation should companies employ?

Recall that the accounting profession uses the term **depletion** for the process of allocating the cost of natural resources.

**Establishing a Depletion Base**

How do we determine the depletion base for natural resources? For example, a company like **ExxonMobil** makes sizable expenditures to find natural resources, and for every successful discovery there are many failures. Furthermore, it encounters long delays between the time it incurs costs and the time it obtains the benefits from the extracted resources. As a result, a company in the extractive industries, like Exxon- Mobil, frequently adopts a conservative policy in accounting for the expenditures related to finding and extracting natural resources. Computation of the depletion base involves four factors: (1) acquisition cost of the deposit, (2) exploration costs, (3) development costs, and (4) restoration costs.

**Acquisition Costs**

**Acquisition cost** is the price ExxonMobil pays to obtain the property right to search and find an undiscovered natural resource. It also can be the price paid for an already discovered resource. A third type of acquisition cost can be lease payments for property containing a productive natural resource; included in these acquisition costs are royalty payments to the owner of the property. Generally, the acquisition cost of natural resources is recorded in an account titled Undeveloped Property. ExxonMobil later assigns that cost to the natural resource if exploration efforts are successful. If the efforts are unsuccessful, it writes off the acquisition cost as a loss.

**Exploration Costs**

As soon as a company has the right to use the property, it often incurs **exploration costs** needed to find the resource. When exploration costs are substantial, some companies capitalize them into the depletion base. In the oil and gas industry, where the costs of finding the resource are significant and the risks of finding the resource are very uncertain, most large companies expense these costs. Smaller oil and gas companies often capitalize these exploration costs.

**Development Costs**

Companies divide **development costs** into two parts: (1) tangible equipment costs and

(2) Intangible development costs. Tangible equipment costs include all of the transportation and other heavy equipment needed to extract the resource and get it ready for market. Because companies can move the heavy equipment from one extracting site to another, companies do not normally include **tangible equipment costs in the depletion base**. Instead, they use separate depreciation charges to allocate the costs of such equipment. However, some tangible assets (e.g., a drilling rig foundation) cannot be moved. Companies depreciate these assets over their useful life or the life of the resource, whichever is shorter. Intangible development costs, on the other hand, are such items as drilling costs, tunnels, shafts, and wells. These costs have no tangible characteristics but are needed for the production of the natural resource. **Intangible development costs are considered part of the depletion base.**

**Restoration Costs**

Companies sometimes incur substantial costs to restore property to its natural state after extraction has occurred. These are **restoration costs**. Companies consider **restoration costs part of the depletion base**. The amount included in the depletion base is the fair value of the obligation to restore the property after extraction. Similar to other long-lived assets, companies deduct from the depletion base any salvage value to be received on the property.

**Write-Off of Resource Cost**

Once the company establishes the depletion base, the next problem is determining how to allocate the cost of the natural resource to accounting periods. Normally, companies compute depletion (often referred to as **cost depletion**) on a **units-of-production method** (an activity approach). Thus, depletion is a function of the number of units extracted during the period. In this approach, the total cost of the natural resource less salvage value is divided by the number of units estimated to be in the resource deposit, to obtain a **cost per unit of product**. To compute depletion, the cost per unit is then multiplied by the number of units extracted.

For example, MaClede Co. acquired the right to use 1,000 acres of land in Alaska to mine for gold. The lease cost is $50,000, and the related exploration costs on the property are $100,000. Intangible development costs incurred in opening the mine are $850,000. Total costs related to the mine before the first ounce of gold is extracted are, therefore, $1,000,000. MaClede estimates that the mine will provide approximately 100,000 ounces of gold. The following table shows computation of the depletion cost per unit (depletion rate).

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If MaClede extracts 25,000 ounces in the first year, then the depletion for the year is $250,000 (25,000 ounces x$10). It records the depletion as follows:

 Inventory 250,000

 Accumulated Depletion 250,000

MaClede debits Inventory for the total depletion for the year and credits Accumulated Depletion to reduce the carrying value of the natural resource. MaClede credits Inventory when it sells the inventory. The amount not sold remains in inventory and is reported in the current assets section of the balance sheet.

Sometimes companies do not use an Accumulated Depletion account. In that case, the credit goes directly to the natural resources asset account. MaClede’s balance sheet would present the cost of the natural resource and the amount of accumulated depletion entered to date as follows:

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In the income statement, the depletion cost is part of the cost of goods sold. MaClede may also depreciate on a units-of-production basis the tangible equipment used in extracting the gold. This approach is appropriate if it can directly assign the estimated lives of the equipment to one given resource deposit. If MaClede uses the equipment on more than one job, other cost allocation methods such as straight line or accelerated depreciation methods would be more appropriate.

**Estimating Recoverable Reserves**

Sometimes companies need to change the estimate of recoverable reserves. They do so either because they have new information or because more sophisticated production processes are available. Natural resources such as oil and gas deposits and some rare metals have recently provided the greatest challenges. Estimates of these reserves are in large measure merely “knowledgeable guesses.”

This problem is the **same as accounting for changes in estimates for the useful lives of plant and equipment**. The procedure is to **revise the depletion rate on a prospective basis**: A company divides the remaining cost by the new estimate of the recoverable reserves.

This approach has much merit because the required estimates are so uncertain.

**Liquidating Dividends**

A company often owns as its only major asset a property from which it intends to extract natural resources. If the company does not expect to purchase additional properties, it may gradually distribute to stockholders their capital investments by paying **liquidating dividends**, which are dividends greater than the amount of accumulated net income.

The major accounting problem is to distinguish between dividends that are a return of capital and those that are not. Because the dividend is a return of the investor’s original contribution, the company issuing a liquidating dividend should debit Paid in

Capital in Excess of Par for that portion related to the original investment, instead of debiting Retained Earnings.

To illustrate, at year-end, Callahan Mining had a retained earnings balance of

$1,650,000, accumulated depletion on mineral properties of $2,100,000, and paid-in capital in excess of par of $5,435,493. Callahan’s board declared a dividend of $3 a share on the 1,000,000 shares outstanding. It records the $3,000,000 cash dividend as follows.

 Retained Earnings 1,650,000

 Paid-in Capital in Excess of Par 1,350,000

 Cash 3,000,000

Callahan must inform stockholders that the $3 dividend per share represents a $1.65 ($1,650,000 /1,000,000 shares) per share return on investment and a $1.35 ($1,350,000 / 1,000,000 shares) per share liquidating dividend.

**PRESENTATION AND ANALYSIS**

**Presentation of Property, Plant, Equipment, and Natural Resources**

A company should disclose the basis of valuation—usually historical cost—for property, plant, equipment, and natural resources along with pledges, liens, and other commitments related to these assets. It should not offset any liability secured by property, plant, equipment, and natural resources against these assets. Instead, this obligation should be reported in the liabilities section. The company should segregate property, plant, and equipment not currently employed as producing assets in the business (such as idle facilities or land held as an investment) from assets used in operations.

When depreciating assets, a company credits a valuation account normally called Accumulated Depreciation. Using an Accumulated Depreciation account permits the user of the financial statements to see the original cost of the asset and the amount of depreciation that the company charged to expense in past years.

When depleting natural resources, some companies use an Accumulated Depletion account. Many, however, simply credit the natural resource account directly. The rationale for this approach is that the natural resources are physically consumed, making direct reduction of the cost of the natural resources appropriate. Because of the significant impact on the financial statements of the depreciation method(s) used, companies should disclose the following.

**a.** Depreciation expense for the period.

**b.** Balances of major classes of depreciable assets, by nature and function.

**c.** Accumulated depreciation, either by major classes of depreciable assets or in total.

**d.** A general description of the method or methods used in computing depreciation with respect to major classes of depreciable assets.

Special disclosure requirements relate to the oil and gas industry. Companies engaged in these activities must disclose the following in their financial statements:

(1) The basic method of accounting for those costs incurred in oil and gas producing activities (e.g., full-cost versus successful-efforts), and (2) how the company disposes of costs relating to extractive activities (e.g., dispensing immediately versus depreciation and depletion).

The 2007 annual report of **International Paper Company** in Illustration below shows an acceptable disclosure. It uses condensed balance sheet data supplemented with details and policies in notes to the financial statements.

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**Analysis of Property, Plant, and Equipment**

Analysts evaluate assets relative to activity (turnover) and profitability.

**Asset Turnover Ratio**

How efficiently a company uses its assets to generate sales is measured by the **asset turnover ratio**. This ratio divides net sales by average total assets for the period. The resulting number is the dollars of sales produced by each dollar invested in assets. To illustrate, we use the following data from the **Tootsie Roll Industries** 2007 annual report.

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The asset turnover ratio shows that Tootsie Roll generated sales of $0.62 per dollar of assets in the year ended December 31, 2007.

Asset turnover ratios vary considerably among industries. For example, a large utility like **Ameren** has a ratio of 0.32 times. A large grocery chain like **Kroger** has a ratio of 2.73 times. Thus, in comparing performance among companies based on the asset turnover ratio, you need to consider the ratio within the context of the industry in which a company operates.

**Profit Margin on Sales Ratio**

Another measure for analyzing the use of property, plant, and equipment is the **profit margin on sales ratio** (rate of return on sales). Calculated as net income divided by net sales, this profitability ratio does not, by itself, answer the question of how profitably a company uses its assets. But by relating the profit margin on sales to the asset turnover during a period of time, we can ascertain how profitably the company used assets during that period of time in a measure of the rate of return on assets. Using the Tootsie

Roll Industries data, we compute the profit margin on sales ratio and the rate of return on assets as follows.

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**Rate of Return on Assets**

The rate of return a company achieves through use of its assets is the **rate of return on assets (ROA)**. Rather than using the profit margin on sales, we can compute it directly by dividing net income by average total assets. Using Tootsie Roll’s data, we compute the ratio as follows.

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The 6.4 percent rate of return computed in this manner equals the 6.4 percent rate computed by multiplying the profit margin on sales by the asset turnover. The rate of return on assets measures profitability well because it combines the effects of profit margin and asset turnover.