



Accounting for Mining

CPE Edition

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Accounting for Mining

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Course Information

Course Title: Accounting for Mining

Learning Objectives:

- Recognize the different types of mineral reserves.
- Describe the depreciation methods most applicable to mining assets.
- Specify how to account for an asset retirement obligation.
- Describe which costs related to environmental contamination should be charged to expense as incurred, and which should be deferred.
- Describe the various assets that may be recognized as part of the accounting for the acquisition of a mining business.

Subject Area: Accounting

Prerequisites: None

Program Level: Overview

Program Content: A mining operation requires a business to incur substantial up-front costs for exploration and development activities, and probably additional costs as part of the mine's eventual closure and site rehabilitation. In *Accounting for Mining*, we describe how to account for the costs incurred at each phase of a mine's development, with particular attention to the more complex topics of asset retirement obligations and environmental obligations. Several additional topics related to asset impairment, business combinations, and financial disclosures are also covered.

Advance Preparation: None

Recommended CPE Credit: 1 hour

Table of Contents

Accounting for Mining	1
<i>Stages of Certainty Regarding Minerals Found</i>	<i>1</i>
<i>Stage 1: Exploration</i>	<i>2</i>
<i>Stage 2: Evaluation</i>	<i>2</i>
<i>Stage 3: Development</i>	<i>2</i>
<i>Stage 4: Construction</i>	<i>3</i>
<i>Stage 5: Production</i>	<i>3</i>
<i>Stage 6: Closure and Rehabilitation</i>	<i>5</i>
<i>Special Topics</i>	<i>5</i>
Depreciation and Amortization	5
Asset Retirement Obligations	6
Environmental Obligations	10
Asset Impairment	13
Business Combinations	13
<i>Financial Disclosures</i>	<i>14</i>
<i>Review Questions</i>	<i>16</i>
Answers to Review Questions	17
Glossary	18
Index	20
Final Examination	21

About the Author

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7 Habits of Effective CEOs	Constraint Management
7 Habits of Effective CFOs	Construction Accounting
7 Habits of Effective Controllers	Corporate Bankruptcy
Accountant Ethics [for multiple states]	Corporate Cash Management
Accountants' Guidebook	Corporate Finance
Accounting Changes and Error Corrections	Cost Accounting (college textbook)
Accounting Controls Guidebook	Cost Accounting Fundamentals
Accounting for Casinos and Gaming	Cost Management Guidebook
Accounting for Derivatives and Hedges	Credit & Collection Guidebook
Accounting for Earnings per Share	Crowdfunding
Accounting for Income Taxes	Developing and Managing Teams
Accounting for Intangible Assets	Effective Collections
Accounting for Inventory	Effective Employee Training
Accounting for Investments	Employee Onboarding
Accounting for Leases	Enterprise Risk Management
Accounting for Managers	Entertainment Industry Accounting
Accounting for Mining	Fair Value Accounting
Accounting for Retirement Benefits	Financial Analysis
Accounting for Stock-Based Compensation	Financial Forecasting and Modeling
Accounting for Vineyards and Wineries	Fixed Asset Accounting
Accounting Procedures Guidebook	Foreign Currency Accounting
Agricultural Accounting	Franchise Accounting
Behavioral Ethics	Fraud Examination
Bookkeeping Guidebook	Fraud Schemes
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Business Insurance Fundamentals	Health Care Accounting
Business Ratios	Hospitality Accounting
Business Valuation	How to Audit Cash
Capital Budgeting	How to Audit Equity
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How to Run a Meeting	Project Management
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IFRS Guidebook	Public Company Accounting
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Investor Relations Guidebook	Records Management
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Optimal Accounting for Cash	The Statement of Cash Flows
Optimal Accounting for Payables	The Year-End Close
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Accounting for Mining

Learning Objectives

- Recognize the different types of mineral reserves.
- Describe the depreciation methods most applicable to mining assets.
- Specify how to account for an asset retirement obligation.
- Describe which costs related to environmental contamination should be charged to expense as incurred, and which should be deferred.
- Describe the various assets that may be recognized as part of the accounting for the acquisition of a mining business.

Introduction

There are multiple phases that a mining business goes through when it is developing a property, and the accounting differs, depending on the phase in which the business is currently engaged. These phases are:

1. Exploration
2. Evaluation
3. Development
4. Construction
5. Production
6. Closure and Rehabilitation

In addition, a mining firm may have to deal with asset retirement obligations, environmental obligations and several other topics, all of which are covered in this course.

Stages of Certainty Regarding Minerals Found

There are several stages of certainty regarding the quantity and quality of the minerals suspected to be located within a region. At the lowest level is the *mineral resource*, which is the concentration of natural solid inorganic or fossilized organic material, including metals, coal and minerals in sufficient quantity and quality to have reasonable prospects for economic extraction. A subset is the *mineral reserve*, which is that portion of the mineral resource that is economically mineable, based on assessments and other supporting information. The mineral reserve classification can be broken down further into the following three classifications¹:

- *Proven reserves*. Reserves for which (a) quantity is computed from dimensions revealed in outcrops, trenches, workings or drill holes, grade and/or quality are computed from the results of detailed sampling and (b) the sites for inspection, sampling and measurement are spaced so closely and the geological character is so well defined that size, shape, depth and mineral content of reserves are well-established.
- *Probable reserves*. Reserves for which quantity and grade and/or quality are computed from information similar to that used for proven reserves, but the sites for inspection, sampling, and measurement are farther apart or are otherwise less adequately spaced. The degree of assurance, although lower than for proven reserves, is high enough to assume continuity between points of observation.

¹ The proven and probable reserve definitions are taken from Industry Guide 7 of the Securities and Exchange Commission, *Description of Property by Issuers Engaged or to be Engaged in Significant Mining Operations*.

- *Possible reserves.* Those unproved reserves which an analysis of the data suggests are less likely to be recoverable than probable reserves.

Stage 1: Exploration

The exploration phase involves the search for mineral deposits that are suitable for exploitation by a commercial enterprise. The activities involved in this stage include the following:

1. Researching existing exploration data and analyzing it for clues about the possible locations of mineral deposits.
2. Engaging in topographical, geological, geochemical, and geophysical studies in targeted areas.
3. Conducting exploratory drilling, trenching, and sampling activities.

The preceding activities all require the mining firm to incur discovery costs. These costs are charged to expense as incurred. They are not capitalized.

Stage 2: Evaluation

The evaluation phase involves determining the commercial viability and technical feasibility of a targeted mineral deposit. The activities involved in this stage include the following:

1. Estimating the grade and volume of deposits.
2. Reviewing and testing extraction methods, as well as associated metallurgical or treatment processes.
3. Determining the infrastructure requirements for the mineral deposit.
4. Reviewing the transportation options available for removing minerals from the mining area.
5. Analyzing the financial feasibility of the proposed mining operation, based on the preceding information.

The costs incurred to conduct these activities should be charged to expense as incurred. They are not capitalized.

Stage 3: Development

The development phase involves the establishment of access to a targeted mineral deposit, along with other preparations needed to engage in commercial production. The costs incurred in this phase may include the following:

- Conducting permanent excavations
- Sinking shafts
- Developing infrastructure, such as the construction of roads and tunnels
- Removing overburden and waste rock

The focus tends to be on assets that provide access to the mineral deposit. Development costs are capitalized until production begins, since the expenditures are intended for the future benefit of the minerals that will be extracted, and those mineral resources and reserves are the source of the value generated by the business; they will generate positive cash flows, and provide the basis upon which debt and equity financing can be obtained.

The development phase is considered to have begun when management concludes that commercially recoverable mineral reserves exist, and has decided to develop the mine. The development phase is assumed to have concluded once sustainable production has commenced. The commencement of sustainable production is an essential milestone, since it defines the end of capitalization and the commencement of the amortization of development costs.

Once production begins, these capitalized costs are amortized as minerals are mined. The units-of-production method is used to amortize the costs. The units-of-production method is described later in the Depreciation and Amortization sub-section. The amortization period for these costs is generally over the estimated life of the mine.

A mining firm may incur stripping costs in the development stage. Stripping costs are incurred when removing overburden or waste rock in order to obtain access to a commercially-producible mineral deposit. If so, and the activity provides better access to the deposit, then the cost should be capitalized along with other development costs. If not, then the stripping cost should be charged to expense as incurred.

Stage 4: Construction

The construction phase involves the establishment of facilities to extract, treat, and transport minerals from the targeted mineral reserve. Examples of construction facilities are:

- Buildings
- Equipment
- Infrastructure
- Machinery

Once these assets have been capitalized, depreciation is initiated at once, since the mine has already been commissioned. The depreciation period is based on the useful life of each individual asset, which may be shorter or longer than the estimated life of the mine.

Stage 5: Production

The production phase involves the exploitation of a mineral deposit. It is considered to have begun when the mining facility has achieved commercial levels of production. Once operations have reached this phase, production costs are generally charged to expense as incurred or added to the value of ending inventory. Production expenditures involve all costs required to extract minerals from the ground, including all depreciation and amortization expenses. The main exception to this expense recognition rule is that costs may still be capitalized when they involve underground development efforts.

One can judge whether a commercial level of production has been reached based on an evaluation of the following criteria:

- Continuous production has been achieved.
- The amount of minerals recovered is near expected levels.

The inventory asset of a mining business is typically divided into the following categories:

- *Work in progress.* Minerals are recognized when it is possible to make a reliable assessment of the mineral content of extracted ore, and a reliable determination can be made of the cost of production.
- *Short term and long term stockpiles.* An asset is recognized through the use of assay testing and physical measurements to determine the quantity of minerals in a stockpile.
- *Heap leaching.* This involves heaping low-grade ore onto an impermeable pad and dumping a solution onto the ore to dissolve the minerals, which are then extracted. An asset is recognized using the same criteria just noted for a stockpile, while also factoring in the proportion of expected metal recovery.
- *Finished goods.* This is minerals ready for delivery to buyers, where all processing has been completed.

Accounting for Mining

When calculating the value of inventory, the accountant should include all conversion costs, as well as any other costs incurred to bring the inventory to its present location and condition. The costs of conversion include production overhead, which typically includes the following costs:

- Depreciation of processing equipment
- Indirect labor
- Supplies
- Utilities required to run the mine

In addition, the value of inventory should include the costs of royalties, any freight costs incurred to bring the inventory to its current location, and any ongoing development costs that are being charged to expense as production costs.

A mining company may incur significant costs to remove the overburden at a mining site; this activity is known as stripping. When stripping costs are incurred during the production phase, the firm should treat these costs as variable production costs. As such, they should be included in the costs of produced inventory during the period in which the stripping costs are incurred. This cost application applies to all types of inventory, including in-process materials and stockpiles.

Some costs incurred during the production phase are charged to expense as incurred, rather than being included in the cost of inventory. These costs include any administrative overhead that is not associated with the mine or the processing facility. Other costs not charged to inventory are:

- Abnormal amounts of wasted production costs, such as labor or materials
- Selling costs
- Storage costs, unless they are involved in a midway point between stages of production

EXAMPLE

Morgan Minerals is engaged in the search for and development of new mines in the Arizona region. It pays \$4,250,000 to contractors to search for copper deposits, which includes exploratory drilling, sampling, and the examination of test results. Morgan charges these costs to expense as incurred.

Based on the results gleaned from the exploration phase, there appear to be three possible sites in Pinal County. Morgan pays a contractor \$200,000 to estimate the grade and volume of deposits at these sites, which narrows down the options to land near Mammoth, Arizona. The company then employs its own engineers to estimate the infrastructure requirements for the mine, including the construction of roads and utility lines. Finally, the company's financial analysts develop a financial feasibility analysis, which management uses to decide in favor of continuing development of the property. The total cost of these evaluation steps is \$300,000, which is charged to expense.

Management concludes that commercially recoverable mineral reserves exist, which commences the development phase for the mine. Morgan spends \$20 million to develop an open pit mine, which includes the removal of a substantial amount of overburden and the construction of an extensive road system. The \$20 million is capitalized.

Following six months of development activities, sustainable production begins. As of this point in time, Morgan begins to amortize the \$20 million that was capitalized during the development stage, with amortization spread over the estimated life of the mine.

Morgan uses heap leaching, using sulfuric acid to dissolve copper from the ore. For the purposes of calculating its inventory asset, the company assumes a 60% recovery rate from its heap leaching process.

The company also spends \$12 million on a copper smelting facility, which is used to heat the copper gathered from its heap leaching process to extract what will eventually be pure copper. This cost is capitalized and depreciated over the life of the buildings and equipment, which is estimated to be 10 years.

During its most recent year of production, the mine incurred \$3.5 million of administrative costs, which were charged to expense as incurred.

Stage 6: Closure and Rehabilitation

The final stage in the operation of a mine is its closure and rehabilitation. The costs associated with this stage include the severance costs for the mine staff, restoration costs, and expenditures associated with the rehabilitation of the site to meet environmental requirements. See the following discussions of asset retirement obligations and environmental obligations, which pertain to the rehabilitation of a mining site.

Special Topics

A number of accounting topics are relevant to the discussion of mining activities. In the following subsections, we address asset impairment, asset retirement obligations, environmental obligations, and more.

Depreciation and Amortization

A mining enterprise engages in a significant amount of asset depreciation and amortization, since it capitalizes significant development costs prior to the start of production, while also capitalizing a variety of fixed asset acquisitions thereafter. Depreciation is typically based on one of two methods. The first is the units-of-production method, where the cost charged to expense is based on the level of production. Thus, more depreciation is charged to expense in periods when there is more production, and less depreciation in periods when there is less production. It is the most accurate method for charging depreciation, since it links closely to the wear and tear on assets. However, one must be able to estimate the total amount of production volume.

Follow these steps to calculate depreciation under the units of production method:

1. Estimate the total number of hours of usage of the asset, or the total number of units to be produced by it over its useful life.
2. Subtract any estimated salvage value from the capitalized cost of the asset, and divide the total estimated usage or production from this net depreciable cost. This yields the depreciation cost per hour of usage or unit of production.
3. Multiply the number of hours of usage or units of actual production by the depreciation cost per hour or unit, which results in the total depreciation expense for the reporting period.

If the estimated number of hours of usage or units of production changes over time, incorporate these changes into the calculation of the depreciation cost per hour or unit of production. This will alter the depreciation expense on a go-forward basis.

EXAMPLE

Pensive Mining's gravel pit operation, Pensive Dirt, builds a conveyor system to extract gravel from a gravel pit at a cost of \$400,000. Pensive expects to use the conveyor to extract 1,000,000 tons of gravel, which results in a depreciation rate of \$0.40 per ton (1,000,000 tons ÷ \$400,000 cost). During the first quarter of activity, Pensive Dirt extracts 10,000 tons of gravel, which results in the following depreciation expense:

$$= \$0.40 \text{ depreciation cost per ton} \times 10,000 \text{ tons of gravel}$$

$$= \$4,000 \text{ depreciation expense}$$

The amortization of deferred mine development costs is typically calculated using the units-of-production method.

In other cases, it makes more sense to use the straight-line method, where costs are charged to expense at a consistent rate, over the expected usage period for the underlying asset. The straight-line calculation steps are:

1. Subtract the estimated salvage value of the asset from the amount at which it is recorded on the books.
2. Determine the estimated useful life of the asset. It is easiest to use a standard useful life for each class of assets.
3. Divide the estimated useful life (in years) into 1 to arrive at the straight-line depreciation rate.
4. Multiply the depreciation rate by the asset cost (less salvage value).

EXAMPLE

Mayfield Mining purchases an ore conveyor for \$200,000. It has an estimated salvage value of \$20,000 and a useful life of five years. Mayfield calculates the annual straight-line depreciation for the machine as:

1. Purchase cost of \$200,000 – Estimated salvage value of \$20,000 = Depreciable asset cost of \$180,000
2. $1 \div 5$ -Year useful life = 20% Depreciation rate per year
3. 20% Depreciation rate \times \$180,000 Depreciable asset cost = \$36,000 Annual depreciation

Asset Retirement Obligations

An asset retirement obligation (ARO) is a liability associated with the retirement of a fixed asset, such as a legal requirement to return a site to its previous condition, which is a situation commonly encountered by mining companies. A company usually incurs an ARO due to a legal obligation. It may also incur an ARO if a company promises a third party (even the public at large) that it will engage in ARO activities; the circumstances of this promise will drive the determination of whether there is an actual liability. This liability may exist even if there has been no formal action against the company. When making the determination of liability, base the evaluation on current laws, not on projections of what laws there may be in the future, when the asset retirement occurs.

EXAMPLE

Uintah Uranium operates a uranium mine, and is required by law to bring the property back to its original condition when the mine is eventually closed. The company has come under some pressure by various environmental organizations to take the remediation one step further and create a public park on the premises. Because of the significant negative publicity generated by these groups, the company issues a press release in which it commits to create the park. There is no legal requirement for the company to incur this additional expense, so Uintah's legal counsel should evaluate the facts to determine if there is a legal obligation.

A business should recognize the fair value of an ARO when it incurs the liability, and if it can make a reasonable estimate of the fair value of the ARO. If a fair value is not initially obtainable, recognize the ARO at a later date, when the fair value becomes available.

Accounting for Mining

If there is not sufficient information available to reasonably estimate the fair value of an ARO, it may be possible to use an expected present value technique that assigns probabilities to cash flows, thereby creating an estimate of the fair value of the ARO. Use an expected present value technique under either of the following scenarios:

- Other parties have specified the settlement date and method of settlement, so that the only uncertainty is whether the obligation will be enforced.
- There is information available from which to estimate the range of possible settlement dates and possible methods of settlement, as well as the probabilities associated with them.

Examples of the sources from which to obtain the information needed for the preceding estimation requirements are past practice within the company, industry practice, the stated intentions of management, or the estimated useful life of the asset (which indicates a likely ARO settlement date at the end of the useful life).

If there is an unambiguous requirement that causes an ARO, but there is a low likelihood of a performance requirement, a liability must still be recognized. When a low probability of performance is incorporated into the expected present value calculation for the ARO liability, this will likely reduce the amount of the ARO to be recognized. Even if there has been a history of non-enforcement of prior AROs for which there was an unambiguous obligation, do not defer the recognition of a liability.

In most cases, the only way to determine the fair value of an ARO is to use an expected present value technique. When constructing an expected present value of future cash flows, incorporate the following points into the calculation:

- *Discount rate.* Use a credit-adjusted risk-free rate to discount cash flows to their present value. Thus, the credit standing of a business may impact the discount rate used.
- *Probability distribution.* When calculating the expected present value of an ARO, and there are only two possible outcomes, assign a 50 percent probability to each one until there is additional information that alters the initial probability distribution. Otherwise, spread the probability across the full set of possible scenarios.

EXAMPLE

Trenton Mining is compiling the cost of a groundwater decontamination ARO several years in the future. It is uncertain of the cost, since supplier fees fluctuate considerably. It arrives at an expected weighted average cash flow based on the following probability analysis:

<u>Cash Flow Estimates</u>	<u>Probability Assessment</u>	<u>Expected Cash Flows</u>
\$12,500,000	10%	\$1,250,000
15,000,000	15%	2,250,000
16,000,000	50%	8,000,000
22,500,000	25%	<u>5,625,000</u>
Weighted average cash flows		<u>\$17,125,000</u>

Follow these steps in calculating the expected present value of an ARO:

1. Estimate the timing and amount of the cash flows associated with the retirement activities.
2. Determine the credit-adjusted risk-free rate.
3. Recognize any period-to-period increase in the carrying amount of the ARO liability as *accretion expense*. To do so, multiply the beginning liability by the credit-adjusted risk-free rate derived when the liability was first measured.

4. Recognize upward liability revisions as a new liability layer, and discount them at the current credit-adjusted risk-free rate.
5. Recognize downward liability revisions by reducing the appropriate liability layer, and discount the reduction at the rate used for the initial recognition of the related liability layer.

When an ARO liability is initially recognized, also capitalize the related asset retirement cost by adding it to the carrying amount of the related fixed asset.

It is possible that an ARO liability will not remain static over the life of the related fixed asset. Instead, the liability may change over time. If the liability increases, consider the incremental increase in each period to be an additional layer of liability, in addition to any previous liability layers. The following points will assist in the recognition of these additional layers:

- Initially recognize each layer at its fair value.

EXAMPLE

Torrey Mining has been operating an open pit mine for three years. It initially recognized an ARO of \$25 million for the eventual restoration of the site after its useful life has ended. In the fifth year, Torrey detects groundwater contamination near its leaching pad, and recognizes an additional layer of ARO liability for \$20 million to deal with it.

-
- Systematically allocate the ARO liability to expense over the useful life of the underlying asset.
 - Measure changes in the liability due to the passage of time, using the credit-adjusted risk-free rate when each layer of liability was first recognized. Recognize this cost as an increase in the liability. When charged to expense, this is classified as accretion expense (which is not the same as interest expense).
 - As the time period shortens before an ARO is realized, the assessment of the timing, amount, and probabilities associated with cash flows will improve. It will likely be necessary to alter the ARO liability based on these changes in estimate. If an upward revision is made in the ARO liability, then discount it using the current credit-adjusted risk-free rate. If a downward revision is made in the ARO liability, discount it using the original credit-adjusted risk-free rate when the liability layer was first recognized. If the liability layer to which the downward adjustment relates cannot be identified, use a weighted-average credit-adjusted risk-free rate to discount it.

An ARO is normally settled only when the underlying fixed asset is retired, though it is possible that some portion of an ARO will be settled prior to asset retirement.

If it becomes apparent that no expenses will be required as part of the retirement of an asset, reverse any remaining unamortized ARO to zero.

EXAMPLE

Sunnyside Mine operates an open pit mine, and is legally required to restore the property when it is decommissioned in five years. The company uses the following assumptions about the ARO:

- The restoration cost is \$9 million.
- The risk-free rate is 5%, to which Sunnyside adds 3% to reflect the effect of its credit standing.
- The assumed rate of inflation over the five-year period is four percent.

With an average inflation rate of 4% per year for the next five years, the current decontamination cost of \$9 million increases to approximately \$10.95 million by the end of the fifth year. The expected present value of the \$10.95 million payout, using the 8% credit-adjusted risk-free rate, is \$7,452,400 (calculated as \$10.95 million \times 0.68058 discount rate).

Accounting for Mining

Sunnyside then calculates the amount of annual accretion using the 8% rate, as shown in the following table:

<u>Year</u>	<u>Beginning Liability</u>	<u>Accretion</u>	<u>Ending Liability</u>
1	\$7,452,400	\$596,200	\$8,048,600
2	8,048,600	643,900	8,692,500
3	8,692,500	695,400	9,387,900
4	9,387,900	751,000	10,138,900
5	10,138,900	811,100	10,950,000

Sunnyside then combines the accretion expense with the straight-line depreciation expense noted in the following table to show how all components of the ARO are charged to expense over the next five years. Note that the accretion expense is carried forward from the preceding table. The depreciation is based on the \$7,452,400 present value of the ARO, spread evenly over five years.

<u>Year</u>	<u>Accretion Expense</u>	<u>Depreciation Expense</u>	<u>Total Expense</u>
1	\$596,200	\$1,490,480	\$2,086,680
2	643,900	1,490,480	2,134,380
3	695,400	1,490,480	2,185,880
4	751,000	1,490,480	2,241,480
5	811,100	1,490,480	<u>2,301,580</u>
			<u>\$10,950,000</u>

After the mine is closed, Sunnyside commences its decontamination activities. The actual cost is \$11.5 million.

Here is a selection of the journal entries that Sunnyside records over the term of the ARO:

	<u>Debit</u>	<u>Credit</u>
Facility decontamination asset	9,000,000	
Asset retirement obligation liability		9,000,000
<i>To record the initial fair value of the asset retirement obligation</i>		

	<u>Debit</u>	<u>Credit</u>
Depreciation expense	1,490,480	
Accumulated depreciation		1,490,480
<i>To record the annual depreciation on the asset retirement obligation</i>		

	<u>Debit</u>	<u>Credit</u>
Accretion expense	As noted in schedule	
Asset retirement obligation liability		As noted in schedule
<i>To record the annual accretion expense on the asset retirement obligation liability</i>		

	<u>Debit</u>	<u>Credit</u>
Loss on ARO settlement	550,000	
Remediation expense		550,000
<i>To record settlement of the excess asset retirement obligation</i>		

Environmental Obligations

There are a number of federal laws that impose an obligation on a business to remediate sites that contain environmentally hazardous conditions, as well as to control or prevent pollution. This can be a particular problem for a mining operation. Remediation can include feasibility studies, cleanup costs, legal fees, government oversight costs, and restoration costs.

In total, these laws can create a serious liability for a mining firm, to the extent of causing it to go bankrupt. Consider, for example, the extent of liability associated with a Superfund site, where liability can be associated with:

- The current owner or operator of the site
- Previous owners or operators of the site at the time of disposal of hazardous substances
- Parties that arranged for the disposal of hazardous substances found at the site
- Parties that transported hazardous substances to the site

The level of liability imposed by other environmental laws may not be as all-encompassing as the Superfund liability, but the level of liability imposed can still be crushing. Accordingly, the accounting for environmental obligations must be well documented, in order to convey the full scope of the liability.

In general, a liability for an environmental obligation should be accrued if both of the following circumstances are present:

- It is probable that an asset has been impaired or a liability has been incurred. This is based on both of the following criteria:
 - An assertion has been made that the business bears responsibility for a past event; and
 - It is probable that the outcome of the assertion will be unfavorable to the business.
- The amount of the loss or a range of loss can be reasonably estimated.

It is recognized that the liability associated with environmental obligations can change dramatically over time, depending on the number and type of hazardous substances involved, the financial condition of other responsible parties, and other factors. Accordingly, the recorded liability associated with environmental obligations can change. Further, it may not be possible to initially estimate some components of the liability, which does not prevent other components of the liability from being recognized as soon as possible.

EXAMPLE

Yerington Mining has been notified by the government that it must conduct a remedial investigation and feasibility study for a Superfund site to which it sent waste rock from its uranium processing mill. There is sufficient information to estimate the cost of the study, for which Yerington records an accrued liability. However, there is no way to initially determine the extent of any additional liabilities associated with the site until the study has at least commenced. Accordingly, the company continually reviews the preliminary findings of the study, and updates the liability for its environmental obligation based on changes in that information.

Once there is information available regarding the extent of an environmental obligation, a business should record its best estimate of the liability. If it is not possible to create a best estimate, then at least a minimum estimate of the liability should be recorded. The estimate is refined as better information becomes available.

In some cases, it is possible to derive a reasonable estimate of liability quite early in the remediation process, because it is similar to the remediation that a business has encountered at other sites. In these instances, the full amount of the liability should be recognized at once.

The costs associated with the treatment of environmental contamination should be charged to expense in nearly all cases. The sole exceptions are:

- The costs incurred will increase the capacity of the property, or extend its life, or improve its safety or efficiency
- The costs incurred are needed to prepare a property for sale that is currently classified as held for sale
- The costs improve the property, as well as mitigate or prevent environmental contamination that has yet to occur and that might otherwise arise from future operations

EXAMPLE

Mesquite Mining spends \$2,500,000 to construct a concrete pad under its leaching field that is designed to prevent sulfuric acid leaks from causing groundwater contamination. Making this investment improves the safety of the property, while also preventing future environmental contamination. Consequently, Mesquite can capitalize the \$2,500,000 cost of the pad, and should depreciate it over the remaining useful life of the property.

In order to determine the extent of the liability associated with an environmental obligation, follow these steps:

1. Identify those parties likely to be considered responsible for the site requiring remediation. These potentially responsible parties may include the following:
 - Participating parties
 - Recalcitrant parties
 - Unproven parties
 - Unknown parties
 - Orphan share parties
2. Determine the likelihood that those parties will pay their share of the liability associated with site remediation, based primarily on their financial condition. There is a presumption that costs will only be allocated among the participating responsible parties, since the other parties are less likely to pay their shares of the liability.
3. Based on the preceding steps, calculate the percentage of the total liability that the company should record. The sources for this information can include the liability percentages that the responsible parties have agreed to, or which have been assigned by a consultant, or which have been assigned by the Environmental Protection Agency (EPA). If the company chooses to record the liability in a different amount, it should be based on objective, verifiable information, examples of which are:
 - Existing data about the types and amounts of waste at the site
 - Prior experience with liability allocations in comparable situations
 - Reports issued by environmental specialists
 - Internal data that refutes EPA allegations

EXAMPLE

Caliente Mining has been notified by the EPA that it is a potentially responsible party in a groundwater contamination case. The EPA has identified three companies as being potentially responsible. The three parties employ an arbitrator to allocate the responsibility for costs among the companies. The arbitrator derives the following allocations:

	<u>Allocation Percentage</u>
Caliente Mining	40%
Great Basin Mining	20%
Kershaw Mining	<u>20%</u>
	80%
Recalcitrant share (nonparticipating parties)	15%
Orphan share (no party can be identified)	<u>5%</u>
Total	<u>100%</u>

The total estimated remediation cost is estimated to be \$5 million. Caliente's direct share of this amount is \$2 million (calculated as \$5 million total remediation \times 40% share). Also, Caliente should record a liability for its share of those amounts allocated to other parties who are not expected to pay their shares, which is \$500,000 (calculated as half of the total allocation for responsible parties \times the cost allocated to the recalcitrant and orphan shares).

The costs that should be included in a company's liability for environmental obligations include the following:

- Direct remediation activity costs, such as investigations, risk assessments, remedial actions, activities related to government oversight, and post-remediation monitoring.
- The compensation and related benefit costs for those employees expected to spend a significant amount of their time on remediation activities.

When measuring these costs, do so for the estimated time periods during which activities will occur, which means that an inflation factor should be included for periods further in the future. It may also be possible to include a productivity factor that is caused by gaining experience with remediation efforts over time, and which may reduce mitigation costs. When it is not possible to estimate the costs of inflation, perhaps due to uncertainties about the timing of expenditures, it is acceptable to initially record costs at their current-cost estimates, and adjust them later, as more precise information becomes available.

Any costs related to routine environmental compliance activities, as well as any litigation costs associated with potential recoveries, are not considered part of the remediation effort, and so are not included in the environmental obligation liability. These costs are to be charged to expense as incurred.

Changes in the environmental liability are especially likely when there are multiple parties involved, since additional parties may be added over time, or the apportionment of liability between parties may change. Also, estimates of the exact amount of cost incurred will change continually. For these reasons, the amount of liability recorded for environmental obligations will almost certainly not be the exact amount that is eventually incurred, and so will have to be updated at regular intervals. If so, each update is treated as a change in estimate, which means that there is no retroactive change in the liability reported by a business; instead, the change is recorded only on a go-forward basis.

Asset Impairment

An asset impairment has occurred when the carrying amount of an asset exceeds its fair value. It is possible that such a condition has arisen when any of the following indicators are present:

- A significant decrease in the market price of the asset.
- A significant adverse change in the physical condition of the asset.
- A significant adverse change in the business climate that could impact the value of the asset.
- A cost accumulation that greatly exceeds the originally expected construction cost of the asset.
- A series of cash flow losses or a projection of future cash flow losses associated with the asset.
- An expectation that the asset will be disposed of significantly prior to the end of its useful life.

An impairment loss should be recognized on a fixed asset if its carrying amount is not recoverable and exceeds its fair value. When this situation arises, the firm must reduce the carrying amount of the asset to its fair value, recognizing a loss on the difference.

The carrying amount of an asset is not recoverable if it exceeds the sum of the undiscounted cash flows expected to result from the use of the asset over its remaining useful life and the final disposition of the asset. A mining company should include in this cash flow analysis any cash flows associated with the value of its proven and probable reserves. These cash flows should include the estimated cash outflows needed to develop and extract the value beyond proven and probable reserves. Thus, both the cash inflows and outflows associated with these reserves must be included in the impairment calculation.

A further consideration when determining impairment is to include in the estimation of future cash flows a consideration of the effects of anticipated fluctuations in the market price of minerals. When doing so, one should consider all available information, such as current prices, historical averages, and forward pricing curves. The assumptions used should be consistent with the firm's operating plans and financial projections related to other aspects of the impairment analysis.

Once adjusted, the revised carrying amount of an asset becomes its new cost basis. The newly-recognized impairment loss cannot be reversed to subsequently increase the carrying amount of the asset.

Business Combinations

When an acquirer buys another company, it accounts for the transaction by allocating the cost of the acquisition to the fair values of the assets and liabilities of the acquiree, with any excess purchase price being charged to the goodwill asset. When conducting this accounting for a mining acquisition, the acquirer should include the value beyond proven and probable reserves in the value allocated to mining assets, to the extent that a market participant would include this value in determining the fair value of the asset.

When allocating the acquisition cost to acquiree assets, the acquirer should also include the effects of any expected fluctuations in the future market price of minerals, doing so in a manner that is consistent with the expectations of marketplace participants. When doing so, one should consider all available information, such as current prices, historical averages, and forward pricing curves. The assumptions used should be consistent with the firm's operating plans and financial projections related to other aspects of the impairment analysis.

Financial Disclosures

When a mining company has reserves, it should disclose the following information for each of the last five years:

- The estimated quantities of proven and probable mineral reserves
- The quantity of each mineral product that is commercially recoverable
- The quantity of each mineral produced within the reporting period
- The quantity of proved and probable mineral reserves bought or sold within the reporting period
- The average market price(s) of each mineral product

If a company's assets are subject to asset retirement obligations, it should disclose the following information:

- *Description.* Describe any asset retirement obligations, as well as fixed assets with which they are associated.
- *Fair values.* Disclose the fair values of any assets that are legally restricted for purposes of setting asset retirement obligations. If it is not possible to reasonably estimate the fair value of an asset retirement obligation, state the reasons for this estimation difficulty.
- *Reconciliation.* Present a reconciliation of the beginning and ending carrying amounts of all asset retirement obligations, in aggregate, showing the changes attributable to the following items:
 - Accretion expense
 - Liabilities incurred in the reporting period
 - Liabilities settled in the reporting period
 - Revisions to estimated cash flows

If a mining business has recorded environmental obligations, it should disclose the following information:

- *Discounting.* Note whether the liability is measured on a discounted basis, the undiscounted amount, and the discount rate used. This is the only disclosure required for environmental obligations.
- *Obligation description.* Companies are encouraged to disclose the circumstances triggering a liability, as well as any policy related to the timing of recognition of recoveries.
- *Loss contingencies.* Disclosure of environmental remediation loss contingencies is encouraged.
- *Liability detail.* Companies are encouraged to disclose additional information about their environmental liabilities, including:
 - The time frame of disbursements
 - The time frame for realization of recognized probable recoveries
 - The reasons why losses cannot be estimated
 - If information about a specific remediation obligation is relevant to understanding the financial statements, note the amount accrued for that site, the nature of any reasonably possible loss contingency and an estimate of the possible loss, whether other potentially responsible parties are involved and the company's share of the obligation, the status of regulatory proceedings, and the time period during which the contingency is likely to be resolved.
 - The expense related to environmental remediation loss contingencies, the amount of any expense reduction caused by recoveries from third parties, and the income statement caption in which these costs and reductions are included.

- *Impact of laws and regulations.* Companies are encouraged to provide a description of the applicability and financial impact of environmental laws and regulations on their business, as well as how this may cause loss contingencies related to the remediation of environmental issues in the future.

If a mining company is publicly held, it is required by the Securities and Exchange Commission to disclose the following information for each mine, plant, or other significant property:

1. *Locations.* The location and means of access to the property.
2. *Descriptions.* A description of the title, claim, lease, or option under which the business has the right to hold or operate the property, noting any conditions that must be met in order to hold the property. If there are leases or options involved, note their expiration dates.
3. *History.* A history of previous operations.
4. *Condition.* Note the condition of the property, the work completed, and the current and proposed exploration and development program. State whether the property has known reserves, and whether the proposed program is exploratory in nature. Also, note the age and condition of the plant and equipment, as well as the source of power used by each property.
5. *Minerals.* Describe the rock formations and mineralization on the property. State the estimated tonnages and grades of proven and probable reserves, as well as the name of the person making the estimates and his/her relationship with the company.
6. *Glossary.* Include a glossary for any technical terms related to geology or mining.
7. *Supplemental information.* If the prior disclosures include estimates of proven and probable reserves, then also supply maps showing mine workings and the outlines of the reserve blocks, drill data, and the calculations used to determine the grade and tonnage of reserves. Also furnish a copy of the engineering, geological or metallurgical reports related to the property. Finally, supply copies of all documents needed to support the representations made in the report, such as title documents, operating permits and easements.

Summary

The accounting related to mining operations is most unique in regard to *when* incurred costs must be charged to expense and when they can be capitalized. Costs incurred during the exploration and evaluation phases are charged to expense as incurred, while costs incurred in the development phase are capitalized. The accountant should be very clear about exactly when the development phase begins, so that cost capitalization can be initiated.

We have included detailed discussions of both asset retirement obligations and environmental obligations, since mining operations are quite likely to result in both of these conditions, to a much greater extent than is the case in other industries.

Review Questions

1. The determination of the infrastructure requirements for a mineral deposit takes place in the ____ stage.
 - a. Exploration
 - b. Evaluation
 - c. Development
 - d. Construction
2. If there is a subsequent increase in an asset retirement obligation:
 - a. Charge any changes in the liability caused by the passage of time to interest expense
 - b. Recognize a new liability layer at its fair value
 - c. Charge the new liability to expense at once
 - d. Do not subsequently change the estimate of the liability
3. The liability associated with a Superfund site can be charged to all of the following, except for:
 - a. Organizations that transported hazardous substances to the site
 - b. The current operator of the site
 - c. The parties providing financing to the current owner of the site
 - d. Previous owners of the site

Answers to Review Questions

Accounting for Mining Review Answers

1. The determination of the infrastructure requirements for a mineral deposit takes place in the ____ stage.
 - a. Exploration
 - b. Evaluation
 - c. Development
 - d. Construction
 - a. Incorrect. The exploration phase involves the search for mineral deposits that are suitable for exploitation.
 - b. **Correct. The evaluation phase includes the determination of infrastructure requirements, as well as the estimation of the grade and volume of deposits and several other activities.**
 - c. Incorrect. The development phase includes such activities as conducting permanent excavations, sinking shafts, and removing overburden.
 - d. Incorrect. The construction phase involves the establishment of facilities to extract, treat, and transport minerals from the targeted mineral reserve.
2. If there is a subsequent increase in an asset retirement obligation:
 - a. Charge any changes in the liability caused by the passage of time to interest expense
 - b. Recognize a new liability layer at its fair value
 - c. Charge the new liability to expense at once
 - d. Do not subsequently change the estimate of the liability
 - a. Incorrect. Charge any changes in the liability caused by the passage of time to accretion expense.
 - b. **Correct. Recognize a new liability layer for an asset retirement obligation at its fair value.**
 - c. Incorrect. Allocate the liability to expense over the useful life of the asset.
 - d. Incorrect. Continually refine the assessment of the liability for the asset retirement obligation.
3. The liability associated with a Superfund site can be charged to all of the following, except for:
 - a. Organizations that transported hazardous substances to the site
 - b. The current operator of the site
 - c. The parties providing financing to the current owner of the site
 - d. Previous owners of the site
 - a. Incorrect. Any person or business that transports hazardous substances to a Superfund site can be assigned liability for cleanup of the site.
 - b. Incorrect. The current operator of the site, even if it is not the owner of the site, can still be held liable for its cleanup.
 - c. **Correct. There is no indication in the Superfund legislation that anyone providing financing to the owner of a Superfund site will be held liable for its cleanup.**
 - d. Incorrect. All previous owners of a designated Superfund site can be held liable for its cleanup.

Glossary

A

Accretion expense. The scheduled recognition of an expense related to a long-term liability. The amount charged to expense represents the change in the remaining discounted cash flows of the liability.

Assay. The testing of ore to determine its ingredients and quality.

Asset retirement obligation. A liability associated with the retirement of a fixed asset.

H

Heap leaching. A process used to recover minerals from low-grade ore, involving the use of a solution that dissolves minerals.

M

Mineral reserve. That portion of a mineral resource that is economically mineable, based on assessments and other information.

Mineral resource. A concentration of natural solid inorganic or fossilized organic material, including metals, coal and minerals in sufficient quantity and quality to have reasonable prospects for economic extraction.

Mineral rights. The legal right to explore, extract, and retain some portion of the benefits from mineral deposits.

Mining assets. Mineral properties and rights.

Mining entity. An organization that is involved in finding and removing wasting natural resources, other than oil and gas.

O

Overburden. The rock or soil overlying a mineral deposit.

P

Probable reserves. Those reserves for which quantity and grade are computed from information similar to what is used for proven reserves; however, the sites for inspection, sampling, and measurement are less adequately spaced. The resulting degree of assurance is sufficiently high to assume continuity between points of observation.

Production phase. A period that begins when saleable materials are removed from an ore body, no matter what the level of production may be.

Proven reserves. Reserves for which the quantity has been computed from the dimensions indicated in outcrops, trenches, drill holes and so forth, while the grade is computed from the results of detailed sampling. In addition, the sampling sites are spaced so close together that the size, shape, depth, and mineral content of reserves can be established.

S

Stockpile. A storage location for minerals held in bulk.

Stripping costs. Those costs incurred when removing overburden or waste materials in order to obtain access to a commercially-producible ore body.

V

Value beyond proven and probable reserves. The economic value associated with a mineral asset beyond the amount attributable to its proven and probable reserves.

W

Waste rock. Barren or marginal ore that has been mined, but which has so little value that it is not worthwhile to engage in additional treatment, so it is discarded.

Work in progress. Ore that has not yet been fully processed.

Index

Asset impairment.....	13	Overview of	10
Asset retirement obligations		Evaluation phase.....	2
Disclosure of.....	14	Exploration phase	2
Measurement of	7	Financial disclosures.....	14
Overview of	6	Mineral reserve	1
Business combinations	13	Mineral resource	1
Closure and rehabilitation phase.....	5	Probable reserve	1
Construction phase	3	Production phase.....	3
Depreciation and amortization.....	5	Proven reserve	1
Development phase.....	2	Public company disclosures.....	15
Environmental obligations		Straight-line method	6
Measurement of	11	Units-of-production method	5

Final Examination

The final examination for this course is provided below. Feel free to circle your choice for the best answer to each question. To enter your answers online and receive an immediate grade and completion certificate, follow these steps:

1. Go to www.accountingtools.com/cpe
 2. Click on the “Access the Training Module | Complete a Test” button near the top of the page.
 3. Login with your user name and password.
 4. Select the **Take a Test** option and then select the **Programs** option. Click on the program that you want to take.
 5. Take the test. You can stop and restart the test at any time.
-

1. A ____ is that portion of a mineral resource that is economically mineable, based on assessments and other supporting information.
 - a. Proven reserve
 - b. Probable reserve
 - c. Mineral resource
 - d. Mineral reserve
2. One of the two depreciation methods commonly used to account for mining assets is:
 - a. The units of production method
 - b. The tax depreciation method
 - c. The sum-of-the-years-digits method
 - d. The double declining balance method
3. Recognition of an asset retirement obligation should be deferred when:
 - a. There is a low likelihood of a performance requirement
 - b. There has been a history of non-enforcement
 - c. A fair value cannot be obtained for it
 - d. An expected present value can be calculated for it
4. The costs associated with the treatment of environmental contamination costs should be charged to expense as incurred when:
 - a. The costs incurred are needed to prepare the property for sale
 - b. The costs incurred relate to sequestering contaminated locations
 - c. The costs incurred will improve the safety of the site
 - d. The costs incurred improve the property
5. An industry-specific asset that the acquirer of a mining enterprise can record as part of its acquisition entry for the purchase is:
 - a. Goodwill
 - b. Inventory
 - c. Land asset
 - d. The value beyond proven and probable reserves