

Cost Allocation: Joint Products and By-products

16 - 1

Introduction

- This chapter considers when companies produce two or more products simultaneously out of the same process(es).
- It examines methods for allocating costs to jointly-produced products.

16 - 2

Identify the splitoff point(s) in a joint-cost situation

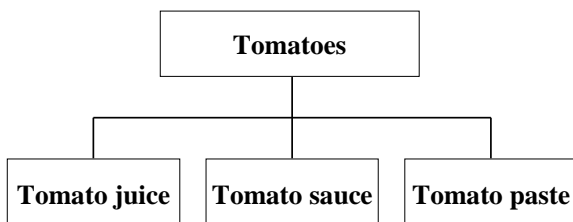
16 - 3

Joint-Cost Basics

- *Joint costs* are the costs of a single production process that yields multiple products simultaneously.
- Industries abound in which a single production process simultaneously yields two or more products.

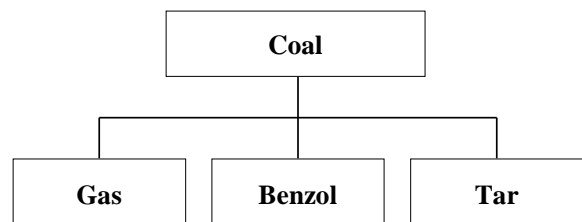
16 - 4

Joint-Cost Basics



16 - 5

Joint-Cost Basics



16 - 6

Joint-Cost Basics

- The outputs of a joint production process can be classified into two general categories:
 - 1 Joint product
 - 2 By-product



16 - 7

Splitoff Point

- The *splitoff point* is the juncture in the production process where one or more products in a joint-cost setting become separately identifiable.
- *Separable costs* are all costs (manufacturing, marketing, distribution, etc.) incurred beyond the splitoff point that are assignable to one or more individual products.

16 - 8

Distinguish between joint products and by-products

16 - 9

Joint Products and By-products

- *Joint products* have relatively high sales value at the splitoff point.
- *Main product* is the result of a joint production process that yields only one product with a relatively high sales value.
- *By-products* are incidental products resulting from the processing of another product.

16 - 10

Joint Products and By-products

- A by-product has a relatively low sales value compared with the sales value of a joint or main product.
- Some outputs of the joint production process have zero sales value.
- No journal entries are made in the accounting system to record the processing of such outputs with zero sales value.

16 - 11

Joint Products and By-products

Main Products

Joint Products

By-products



High

Low



16 - 12

Joint Products and By-products

- The classification of products as main, joint, or by-product depends on its sales value.
- Products can change from by-products to joint products when their relative sales values increases and changes from joint products to by-products when their relative sales value decreases.

16 - 13

Allocate joint costs using several different methods

16 - 14

Approaches to Allocating Joint Costs

- The two basic approaches to allocating joint costs are:
- *Approach 1*: Allocate costs using market-based data such as revenues.
- *Approach 2*: Allocate costs in some physical measure-based data such as weight or volume.

16 - 15

Allocating Joint Costs

- *Approach 1*:
- The sales value at splitoff method
- The estimated net realizable value (NRV) method
- The constant gross-margin percentage NRV method

16 - 16

Allocating Joint Costs

- Lubbock Company incurred \$200,000 of joint costs to produce the following:
- Product A: 10,000 units, 20,000 pounds
- Product B: 10,500 units, 48,000 pounds
- Product C: 11,500 units, 12,000 pounds

16 - 17

Sales Value at Splitoff Method

- The sales value at splitoff method allocates joint costs to joint products on the basis of the relative sales value at the splitoff point of the total production of these products during the accounting period.

16 - 18

Sales Value at Splitoff Method

- Assume the following sales values per unit:
A: \$10.00, B: \$30.00, and C: \$20.00
- What is the sales value at splitoff point?
- Product A: $10,000 \times \$10.00 = \$100,000$
- Product B: $10,500 \times \$30.00 = 315,000$
- Product C: $11,500 \times \$20.00 = \underline{230,000}$
- Total \$645,000

16 - 19

Sales Value at Splitoff Method

- How much of the joint costs are allocated to each product?
- Product A:
 $\$100,000/\$645,000 \times \$200,000 = \$ 31,008$
- Product B:
 $\$315,000/\$645,000 \times \$200,000 = 97,674$
- Product C:
 $\$230,000/\$645,000 \times \$200,000 = \underline{71,318}$
- Total \$200,000

16 - 20

Sales Value at Splitoff Method

- What are the joint production costs per unit?
- Product A: $\$31,008 \div 10,000 = \3.10
- Product B: $\$97,674 \div 10,500 = \9.30
- Product C: $\$71,318 \div 11,500 = \6.20



16 - 21

Sales Value at Splitoff Method

- Assume all of the units produced of B and C were sold.
- 2,500 units of A (25%) remain in inventory.
- What is the gross margin percentage of each product?

16 - 22

Sales Value at Splitoff Method

	<u>Product A</u>
Revenues: 7,500 units \times \$10.00	\$75,000
Cost of goods sold:	
Joint product costs	\$31,008
Less ending inventory	
\$31,008 \times 25%	<u>7,752</u> <u>23,256</u>
Gross margin	\$51,744

16 - 23

Sales Value at Splitoff Method

- Product A:
 $\$75,000 - \$23,256 = \$51,744$
 $\$51,744 \div \$75,000 = 69\%$
- Product B:
 $(\$315,000 - \$97,674) \div \$315,000 = 69\%$
- Product C:
 $(\$230,000 - \$71,318) \div \$230,000 = 69\%$

16 - 24

Sales Value at Splitoff Method

- Note that this method uses the sales value of the entire production of the accounting period.
- Joint costs were incurred on all units produced, not just those sold.
- The *sales value at splitoff method* produces an identical gross margin percentage for each product.

16 - 25

Estimated Net Realizable Value (NRV) Method

- In many cases, products are processed further beyond the splitoff point in order to bring them to a marketable form or to increase their value above their selling price at the splitoff point.



16 - 26

Estimated Net Realizable Value (NRV) Method

- The estimated NRV method allocates joint costs to joint products on the basis of the relative estimated NRV.
- The estimated NRV is the expected final sales value in the ordinary course of business minus the expected separable costs of the total production of these products during the accounting period.

16 - 27

Estimated Net Realizable Value (NRV) Method

- Assume that Lubbock Company can process products A, B, and C further into A1, B1, and C1.
- The new sales value after further processing are:
- A1: $10,000 \times \$12.00 = \$120,000$
- B1: $10,500 \times \$33.00 = \$346,500$
- C1: $11,500 \times \$21.00 = \$241,500$

16 - 28

Estimated Net Realizable Value (NRV) Method

- Additional processing (separable) costs are as follows:
- A1: \$35,000; B1: \$46,500; and C1: \$51,500
- What is the estimated net realizable value of each product at the splitoff point?

16 - 29

Estimated Net Realizable Value (NRV) Method

- Product A1: $\$120,000 - \$35,000 = \$85,000$ estimated net realizable value
- Product B1: $\$346,500 - \$46,500 = \$300,000$ estimated net realizable value
- Product C1: $\$241,500 - \$51,500 = \$190,000$ estimated net realizable value
- How much of the joint cost is allocated to each product?

16 - 30

Estimated Net Realizable Value (NRV) Method

	Estimated Net Realizable Value	Weight
Product A1	\$ 85,000	85/575
Product B1	300,000	300/575
Product C1	<u>190,000</u>	190/575
Total	\$575,000	

16 - 31

Estimated Net Realizable Value (NRV) Method

- Product A1: $85/575 \times \$200,000 = \$ 29,565$
- Product B1: $300/575 \times \$200,000 = 104,348$
- Product C1: $190/575 \times \$200,000 = \underline{66,087}$
- Total \$200,000



16 - 32

Estimated Net Realizable Value (NRV) Method

	Allocated joint costs	Separable costs	Inventory costs
A1	\$ 29,565	\$ 35,000	\$ 64,565
B1	104,348	46,500	150,848
C1	<u>66,087</u>	<u>51,500</u>	<u>117,587</u>
Total	\$200,000	\$133,000	\$333,000

16 - 33

Estimated Net Realizable Value (NRV) Method

- What is the production cost per unit?
- Product A1: $\$64,565 \div 10,000 = \6.46
- Product B1: $\$150,848 \div 10,500 = \14.37
- Product C1: $\$117,587 \div 11,500 = \10.22

16 - 34

Constant Gross-Margin Percentage NRV Method

- The constant gross-margin percentage NRV method allocates joint costs to joint products in such a way that the overall gross-margin percentage is identical for each of the individual products.

16 - 35

Constant Gross-Margin Percentage NRV Method

- This method entails three steps:
- Step 1: Compute the overall gross-margin percentage.
- Step 2: Use the overall gross-margin percentage and deduct the gross margin from the final sales values to obtain the total costs that each product should bear.

16 - 36

Constant Gross-Margin Percentage NRV Method

- Step 3: Deduct the expected separable costs from the total costs to obtain the joint-cost allocation.



16 - 37

Constant Gross-Margin Percentage NRV Method

- What is the expected final sales value of total production during the accounting period?
- Product A1: \$120,000
Product B1: 346,500
Product C1: 241,500
Total \$708,000

16 - 38

Constant Gross-Margin Percentage NRV Method

- Step 1: Compute the overall gross-margin percentage.
- Expected final sales value \$708,000
Deduct joint and separable costs 333,000
Gross margin \$375,000
- Gross margin percentage:
 $\$375,000 \div \$708,000 = 52.966\%$

16 - 39

Constant Gross-Margin Percentage NRV Method

- Step 2: Deduct the gross margin.
 -
- | | <u>Sales</u>
<u>Value</u> | <u>Gross</u>
<u>Margin</u> | <u>Cost of</u>
<u>Goods sold</u> |
|-------------|------------------------------|-------------------------------|-------------------------------------|
| Product A1: | \$120,000 | \$ 63,559 | \$ 56,441 |
| Product B1: | 346,500 | 183,527 | 162,973 |
| Product C1: | <u>241,500</u> | <u>127,913</u> | <u>113,587</u> |
| Total | \$708,000 | \$375,000 | \$333,000 |
- (\$1 rounding)

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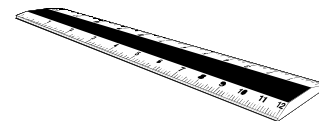
Constant Gross-Margin Percentage NRV Method

- Step 3: Deduct separable costs.
 -
- | | <u>Cost of</u>
<u>goods sold</u> | <u>Separable</u>
<u>costs</u> | <u>Joint costs</u>
<u>allocated</u> |
|-------------|-------------------------------------|----------------------------------|--|
| Product A1: | \$ 56,441 | \$ 35,000 | \$ 21,441 |
| Product B1: | 162,973 | 46,500 | 116,473 |
| Product C1: | <u>113,587</u> | <u>51,500</u> | <u>62,087</u> |
| Total | \$333,000 | \$133,000 | \$200,000 |

16 - 41

Physical Measure Method

- The physical measure method allocates joint costs to joint products on the basis of the relative weight, volume, or other physical measure at the splitoff point of the total production of these products during the accounting period.



16 - 42

Physical Measure Method

- Recall that Lubbock Company incurred \$200,00 of joint costs to produce A, B, and C products.
- Product A: 10,000 units, 20,000 pounds
- Product B: 10,500 units, 48,000 pounds
- Product C: 11,500 units, 12,000 pounds

16 - 43

Physical Measure Method

- What are the joint costs allocated to each product using the number of pounds produced as the physical measure?
- Product A: $20,000/80,000 \times \$200,000 = \$50,000$
- Product B: $48,000/80,000 \times \$200,000 = \$120,000$
- Product C: $12,000/80,000 \times \$200,000 = \$30,000$

16 - 44

Physical Measure Method

- What is the cost per pound for each product?
- Product A: $\$50,000 \div 20,000 = \2.50
Product B: $\$120,000 \div 48,000 = \2.50
Product C: $\$30,000 \div 12,000 = \2.50
- It is possible to obtain the cost per pound ($\$200,000 \div 80,000 = \2.50) and use this amount to distribute the joint costs.

16 - 45

Physical Measure Method

- Under the benefits-received criterion, the physical measure method is less preferred than the sales value at splitoff method.
- Why?
- Because it has no relationship to the revenue-producing power of the individual products.

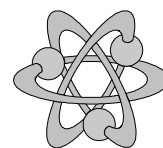
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Identify the criterion used to support market-based joint cost allocation methods

16 - 47

Comparison of Methods

- Which method of allocating joint costs should be chosen?
- The sales value at splitoff method is widely used where market prices exist at splitoff.



16 - 48

Comparison of Methods

- Why is the sales value at splitoff method widely used?
 - It is objective.
 - It does not anticipate subsequent management decisions on further processing.
 - It uses a meaningful common denominator.
 - It is simple.

16 - 49

Comparison of Methods

- The purpose of the joint-cost allocation is important in choosing the allocation method.
- The physical measure method is a more appropriate method to use in rate regulation.

16 - 50

Avoiding Joint Cost Allocation

- Some companies refrain from allocating joint costs entirely. Instead, they carry their inventories at estimated NRV.
- Accountants ordinarily criticize carrying inventories at estimated net realizable values.
- Why?
 - Because income is recognized before sales are made.

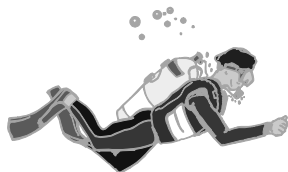
16 - 51

Explain why joint costs are irrelevant in a sell-or-process further decision

16 - 52

Irrelevance of Joint Costs for Decision Making

- Joint costs incurred up to the splitoff point are past (sunk) costs irrelevant to the decision to sell a joint (or main) product at the splitoff point or to process it further.



16 - 53

Irrelevance of Joint Costs for Decision Making

- Assume that products A, B, and C can be sold at the splitoff point or processed further into A1, B1, and C1.

<u>Units</u>	<u>Selling price</u>	<u>Selling price</u>	<u>Additional costs</u>
10,000	A: \$10	A1: \$12	\$35,000
10,500	B: \$30	B1: \$33	\$46,500
11,500	C: \$20	C1: \$21	\$51,500

16 - 54

Irrelevance of Joint Costs for Decision Making

- Should A, B, or C be sold at the splitoff point or processed further?
- Product A: Incremental revenue \$20,000
– Incremental cost \$35,000 = (\$15,000)
- Product B: Incremental revenue \$31,500
– Incremental cost \$46,500 = (\$15,000)
- Product C: Incremental revenue \$11,500
– Incremental cost \$51,500 = (\$40,000)

16 - 55

Irrelevance of Joint Costs for Decision Making

- Products A, B, and C should be sold at the splitoff point.
- No techniques for allocating joint-product costs should guide decisions about whether a product should be sold at the splitoff point or processed beyond splitoff.



16 - 56

Account for by-products using two different methods

16 - 57

Accounting for By-products

- Although by-products have much lower sales value than do joint or main products, the presence of by-products can affect the allocation of joint costs.
- By-product accounting methods differ on whether by-products are recognized in the financial statements at the time of production or the time of sale.

16 - 58

Accounting for By-products

- 1 Method A, the production by-product method, recognizes by-products in the financial statements at the time their production is completed.
- 2 Method B, the sale by-products method, delays recognition of by-products until the time of their sale.

16 - 59

Accounting for By-products

- The following data relates to Los Alamos, Inc., a manufacturer of special clothes used by joggers.



16 - 60

Accounting for By-products

	Main Products (Yards)	By-Products (Yards)
Production	1,000	400
Sales	800	300
Ending inventory	200	100
Sales price	\$13/yard	\$1.00/yard
No beginning finished goods inventory		

16 - 61

Accounting for By-products

Joint production costs for joint (main) products and by-products:	
Material	\$2,000
Manufacturing labor	3,000
Manufacturing overhead	<u>4,000</u>
Total production cost	\$9,000

16 - 62

Accounting for By-products Method A

- Method A: Net realizable value assigned to by-products inventory
- What is the value of ending inventory of joint (main) products?
- \$9,000 total production cost – \$400 net realizable value of the by-product = \$8,600 net production cost for the joint products.
- $200 \div 1,000 \times \$8,600 = \$1,720$ is the value assigned to the 200 yards in ending inventory.

16 - 63

Accounting for By-products Method A

- What is the cost of goods sold?
- Joint production costs \$9,000
- Less by-product revenue 400
- Less main product inventory 1,720
- Cost of goods sold \$6,880

16 - 64

Accounting for By-products Method A

- Income Statement (Method A)
- Revenues (800 yards \times \$13) \$10,400
- Cost of goods sold 6,880
- Gross margin \$ 3,520
- What is the gross margin percentage?
- $\$3,520 \div \$10,400 = 33.85\%$

16 - 65

Accounting for By-products Method A

- What are the inventoriable costs?
- Main product: $200 \div 1,000 \times \$8,600 = \$1,720$
- By-product: $100 \times \$1.00 = \100



16 - 66

Journal Entries Method A

- Work-in-Process 2,000
 Accounts Payable 2,000
 To record direct materials purchased and used in production
- Work-in-Process 7,000
 Various accounts 7,000
 To record conversion costs in the joint process

16 - 67

Journal Entries Method A

- By-product Inventory 400
 Finished Goods 8,600
 Work-in-Process 9,000
 To record cost of goods completed
- Cost of Goods Sold 6,880
 Finished Goods 6,880
 To record the cost of the main product sold

16 - 68

Journal Entries Method A

- Cash or Accounts Receivable 10,400
 Revenues 10,400
 To record the sale of the main product



16 - 69

Accounting for By-products Method B

- Method B: The sale by-products method.
- What is the value of ending inventory of joint (main) products?
- $200 \div 1,000 \times \$9,000 = \$1,800$
- This method assigns no value to the 400 yards of by-products at the time of production.
- The \$300 resulting from the sale of by-products is reported as revenues.

16 - 70

Accounting for By-products Method B

Income Statement (Method B)

Revenues:	
Main product (800 × \$13)	\$10,400
By-products sold	<u>300</u>
Total revenues	\$10,700

16 - 71

Accounting for By-products Method B

Income Statement (Method B)

Total revenues	\$10,700
● Cost of goods sold:	
Joint production costs	9,000
Less main product inventory	<u>1,800</u>
	\$ 7,200
● Gross margin	\$ 3,200

16 - 72

