



3 Teacher's notes – Volume 3 – Material flow analysis

Volume 3 – Material flow analysis – provides an introduction to the topic and gives various examples. It is designed for trainers who teach consultants or trainers.

The teacher's notes provide comments on **training courses (workshops)**.

The background material can be used as described below.

Use of the background material "Material flow analysis"	
Material	Comment
Textbook	The textbook provides the basic background information. The trainer should be familiar with the subject before starting the training or workshop. The textbook itself can be distributed as training material to the participants.
Examples	Four examples illustrate the practical implementation of a material flow analysis: <ul style="list-style-type: none">- Flowchart of a dairy company: A flowchart of a dairy process focusing on water flows is drawn. The example is prepared as a slide presentation and can also be used as an exercise.- Water flow in a winery: The water balance of a winery illustrates that sometimes process steps are missing. If they are detected significant savings can be achieved (here the backwashing of the sand filters).- Cleaning in Place – CIP: Cleaning in the food industry requires a large amount of water and chemicals. In order to reduce the material flows, Cleaning in Place can be applied.- Close the shop: A strategy for analysing the material flow called "Close the shop" is presented for a metal manufacturing company.
Exercises	The exercises support the knowledge transfer to the participants. They are designed for group work in a training course but can also be used as individual exercises. The participants learn to carry out a material flow analysis, draw flow charts and calculate mass balances. <ul style="list-style-type: none">- Fish factory: The participants have to draw a flowchart for the raw material fish and for water based on the description of a fish filleting process.- Making coffee: This is a very practical exercise with hands-on activities. The participants learn to draw a material balance and to find CP options. If time and equipment are available, it is a very valuable group work. This exercise can be extended to energy aspects (see also Volume 4, Exercise 4-5).- Water balance for an office and residential building: A water balance is calculated according to measurements and indicators.- Pickling process: This is a more advanced calculation including a chemical reaction.

Use of the background material "Material flow analysis"	
Material	Comment
Slides	The slides can be used for an introductory presentation on the subject of material flow analyses. The definition and basic steps of a material flow analysis are presented and the practical application is demonstrated step by step for a painting process. The slides can be completed by own charts, project experience, etc.
Worksheets	<p>The worksheets support the participants in carrying out a material flow analysis. As an example, the worksheets have been completed using the case study of a brewery.</p> <p>The following worksheets are included:</p> <ul style="list-style-type: none"> - <i>Flowchart (Worksheet 3-1)</i>: drawing a flowchart for any material or production flow; - <i>Water data sheet (Worksheet 3-2)</i>: using this worksheet data for a water balance are collected; - <i>Material tracing sheet (Worksheet 3-3)</i>: for any material balance. <p>The worksheets can also be opened as <i>doc.files</i>.</p>
Questions	<p>The questions check the participants' understanding of the information covered during the training course or workshop. Most of the information is included in the textbook, therefore links to the textbook are provided. The trainer can decide if and how he checks the participants' knowledge and if he wishes to use these questions.</p> <p>In addition, the questions can be used as a quick self-check for the trainer.</p>
Checklists	The checklists help the trainer to prepare the training course or the workshop and to start the in-company work.

Training course/workshop

The participants of a workshop or training course on "Material flow analysis" are consultants or trainers.

The following table shows an example schedule of a one-day workshop which is designed as part of a series of workshops. This schedule has proved to be efficient with different target groups.

The second table comprises the suggested materials, learning objectives and success indicators for the different teaching units.



Example schedule for a training course/workshop "Material flow analysis"

Topic	Content	Time	Min.	Method
Welcome		9.00	15	
	Welcome of participants		5	All
	Programme of the day, organizational matters		5	All, flipchart
Feedback		9.10	20	
	Feedback of the participants regarding experience from the previous workshops and/or in-company work		20	All
Introduction to material flow analysis		9.30	75	
	Introduction to material flow analysis and data collection; various examples		75	Presentation by an expert, using an overhead projector or beamer (slides, textbook and examples)
Coffee break		10.45	30	
Drawing a flowchart		11.15	60	
	Additional exercises (heat exchanger, hot water – solar collector) (Exercise 3-1)		10 40 10	Explanation Group work and Evaluation
Lunch		12.15	75	
Making coffee		13.30	90	
	Practical hands-on exercise (good after lunch) (Exercise 3-2)		10 50 30	Explanation Group work Presentation/evaluation
Break		15.00	30	
Exercises		15.30	50	
	Calculating material flows – water balance (Exercise 3-3)		40 10	Group work and Evaluation
	Optional or additional: pickling process (Exercise 3-4)			
Optional: Water management		15.30	50	
	Water management in a company – CP options for water use, cleaning and wastewater		50	Presentation by an expert, using an overhead projector or beamer
Discussion, continuation		16.20	40	
	Presentation and discussion of worksheets		10	Presentation (worksheets)
	Discussion of the topic of the day, summary of major aspects, continuation of the work, explanation of training material, homework		30	Plenary discussion
End		17.00		

Explanation of the topics of the training course	
Topic	Material/learning objectives/success indicators
Introduction to material flow analysis	<p><i>Material:</i></p> <ul style="list-style-type: none"> - Transparencies from the background material and additional own transparencies; - Textbook of this volume; - Examples of this volume. <p><i>Learning objectives:</i></p> <ul style="list-style-type: none"> - Make the participants familiar with the concept of material flow analysis; - Provide examples for material flow analyses and illustrate the importance. <p><i>Success indicators:</i></p> <ul style="list-style-type: none"> - The participants are familiar with the seven steps of a material flow analysis; - The participants understand why a material flow analysis is important for finding CP options.
Group work: Fish factory	<p><i>Material:</i></p> <ul style="list-style-type: none"> - Exercise 3-1 from the Exercise section. <p><i>Learning objective:</i></p> <ul style="list-style-type: none"> - Draw a flowchart based on a process description. <p><i>Success indicator:</i></p> <ul style="list-style-type: none"> - The participants can convert a description into a flowchart. <p>Comment: This is a valuable exercise. Even for experienced persons it is not always easy to convert a description into a flowchart. Here training and exercises can help.</p>
Exercise: Making coffee	<p><i>Material:</i></p> <ul style="list-style-type: none"> - Flipchart; for equipment and tools see background material (Exercise 3-2). <p><i>Learning objectives:</i></p> <ul style="list-style-type: none"> - Simulate a production process and draw up a material flow for the raw materials; - Calculate in mass units. <p><i>Success indicators:</i></p> <ul style="list-style-type: none"> - The participants draw up a consistent balance; - The participants recognize CP options; - The participants can convert this production simulation into their own production and company "language".
Exercise	<p><i>Material:</i></p> <ul style="list-style-type: none"> - See background material Exercise 3-3 or Exercise 3-4. <p><i>Learning objectives:</i></p> <ul style="list-style-type: none"> - Draw up a balance for the mentioned material and find options; - Learn to use indicators (in Exercise 3-3) for estimating a balance. <p><i>Success indicator:</i></p> <ul style="list-style-type: none"> - The participants can draw up the balance and use the indicators. <p>Comment: Exercise 3-4 (The pickling process) includes a chemical reaction and is rather difficult. Therefore it might not be suitable for every participant.</p>