THE DESIGN MODEL OF ENVIRONMENTAL MANAGEMENT ACCOUNTING (EMA) USING MATERIAL FLOW COST ACCOUNTING (MFCA) APPROACH (CASE STUDY IN PT SEMEN PADANG)

THESIS

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With all love and bleed...

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The Design Model of Environment Management Accounting (EMA) Using Material Flow Cost Accounting (MFCA). (Case Study in PT Semen Padang)

Thesis by: Yahya Tamrin
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ABSTRACT

This research develops a new model of Environmental Management Accounting (EMA) based on the principle develop by International Federation Accountants (IFAC) 2005. This paper explores the cost component in the Environmental Domains as the character of the Environmental Report version of IFAC. There are three among six of cost component that author can investigate during the research: Material Cost of Product Output, Material Cost of Non Product Output, Waste and Emission Control Cost. The author can't discover another three cost component in PT Semen Padang. The total of Environmental Cost during 2010 found as Rp. 337,803,516,916.95 or 11% of the total manufacturing cost. This information gathered hope can help the company to reduce the activity that impact to the environmental damage.

The method being used for EMA is Material Flow Cost Accounting (MFCA), developed by Japanese Ministry Economic, Trading and Industry (METI). Based on the method used, it found Rp. 1,696,864,063.38 of material losses during the production process. The aim of using this method is to elaborate the cost component to be reduced and waste management. Firstly, this research will sort the material loss during the production. Secondly, it calculate the Environmental Cost during year 2010.

Keyword: *Environmental Management Accounting, Environmental Cost, Physical Information, Monetary Information. Material Flow Cost Accounting, Material Loss.*

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CHAPTER I

INTRODUCTION

I.1 Problem Backround

Currently, along with technology and global economics development, the environmental issues becoming an interest topic to be studied. Indonesia as a developing country could not be separated from the environmental problem which the impact is increasingly felt day by day. The era of industrialization in one side, focuses on the use of technology as efficiently as possible, so sometimes ignore the environmental aspects. Nowadays, Indonesian public awareness about the importance of environment begins to grow slowly. People do not just thinking about its own survival, but they are more concern and critical for the place where they make living, whether they act as an individual or a global society. One of the concerns could be seen toward corporate action in community and environment (Syafendri, 2010)

Every manufacture company now days should take care about the Environmental issues. Because of many internal and external stakeholders are showing increasing interest in the environmental performance of organizations, particularly private sector companies. An example of internal stakeholders might be employees affected by pollution in the work environment. External stakeholders include communities affected by local pollution, environmental activist groups, government regulators, shareholders, investors, customers, suppliers and others.

One of the main objectives of environmental accounting is to study the economic activities of production and consumption and understand how these activities impact upon the environment. To do this, it is useful to define the economy in physical terms, as the activities that use materials or energy to produce goods and services that can be exchanged for money. The environment constitutes the physical surroundings in which the economy operates, to which it is physically linked, and to which materials return once they have been disposed of by the economy.

By measuring the physical movement of materials between the economy and the environment, it is possible to draw up a material flow account which balances the inputs (extraction of natural resources from the environment, and imports of goods) with the outputs (wastes, emissions and exports) and accumulation of stock (in terms of new buildings, etc.) within the economy. This mass balance concept is based on the principle that matter can neither be created nor destroyed. Items in the accounts vary from gases such as carbon dioxide to bulk materials such as coal or wood. When linked to changes in economic activity, it should be possible to draw conclusions about the extent to which economic progress is becoming de-coupled from resource use (Sheerin,UK MFA).

The development of Environmental Management Accounting required the organization to asses the cost correctly, not only monetary data but also non-monetary data on material use, personal hour and other cost driver. EMA places a particular emphasis on materials and materials-driven cost because: (1) use of energy, water and materials, as well as the generation of waste and emissions, are directly related to many of the impacts organizations have on their environments and (2) materials purchase cost are a major cost driver in many organization (IFAC 2005).

Many organization purchase the energy, water and other material to support their activities. The using of the material could be efficient or not, some of them are processed to be a second product depends on the quality of additional material which mixed to the primary material. The scars of the material could through away as the toxic, hazardous, gas emissions, and other kind of waste. The number could various among the company depend on the level of quality of machinery and the level of human error.

PT SEMEN PADANG is one of the manufacture company in Indonesia where consume the natural resources as the Primary raw material. The Cost of product are traced based on Direct Raw Material, Direct Labour Hour, and The Factory Overhead cost. Since this Company operate not only to scratch the profit as much as possible, it should consider the effectiveness of operation, save the environment, and trace the price accurately to the product.

One of the methodologies to do this, experts develop the accounting method from traditional to the full cost accounting. Using analysis of Material Flow cost Accounting as the new accounting management tool to calculate all the hidden cost in making product, hope the management can operate more effective and efficient, and be able to control the cost of production.

Material flow analysis (MFA) refers to the analysis of the throughput of process chains comprising the extraction or harvest, chemical transformation, manufacturing, consumption, recycling, and disposal of materials. It is based on accounts in physical units (usually in terms of tons) quantifying the inputs and outputs of those processes. The subjects of the accounting are chemically defined substances (e.g. carbon or carbon dioxide) on the one hand and natural or technical compounds or 'bulk' materials (e.g. coal, wood) on the other hand (WGEIO 2000).

Material Flow cost accounting (MFCA) has been introduced by some enterprise in Japan as a tool of Environmental Management Accounting, and has led improvement activities and production innovation to attain simultaneously both of the reduction of environmental impact and the enhancement of economy, and has produced concrete results (cost reduction).On the other hand, questions have been asked about what is the different between conventional Production management information, or management accounting information, or if they are the same (Nakajima 2008).

Organizations seek management tools to link environment with economy. In this respect, MFCA is a valuable management tool, which promotes efficient use of materials more effectively, contributing to reduction of emission (waste). Further, MFCA is a major method in environmental management accounting specialized for the internal management of an enterprise, and is applied to measuring flows and stocks of materials (raw materials and energy) and input of labor in a manufacturing process, in terms of physical and monetary units, and is characterized by identifying accurate costs of wastes and emissions (Furukawa).

Identifying the material cost, the company can assess the cost of the product actually and know cost for hazardous, toxic, waste water, etc. Because of some reason, the writer is interesting to research this kind of the cost flow in PT SEMEN PADANG that operates in producing cement by comparing the conventional accounting method with the current method called Material Flow Cost Accounting. Knowing the actual cost for the processing and material cost will help the Company to be able make a decision correctly.

This thesis is the primary research which trying to discuss the importance of using Material Flow Accounting by designs the model of MFCA. The research wiil be conducted in PT SEMEN PADANG as the manufacturing Company in which produce the annual report and Environmental report on the research period.

The selection of PT SEMEN PADANG because the company more related to the natural exploration which considered produced waste and hazardous, where the cost of hazard and waste in manufacturing process still not consider tracing well to the product. PT Semen Padang's core operation is closely related to environment issues. Thus, the researcher view, there is a need by the company in using Material flow Analysis Cost Accounting and Environmental Management

Accounting in gaining more effective and efficiency in production activity in manufacturing company.

I.2 Problem Definition

Issue about Environmental Management Accounting base Material Flow Cost Accounting is brand new for Indonesian business entity moreover in Indonesia. Based on the background above, the problem that can be discussed in this research; "(1) how can the Environmental Management Accounting based Material Flow Cost Accounting be implemented in PT Semen Padang? (2) How to manage environmental activities as one of the way to gain competitive advantage "

I.3. Research Objective

First, this research tries to understand and show the possibilities of using Material Flow Cost Accounting in calculating material loss of raw material during the production process. So, the Management could provide the appropriate price of the product and present the accurate information in reporting financial statement in gaining the more effective and efficiency of activity in PT Semen Padang. The output of this design is Material Flow Analysis Report which can be published for internal parties in order to understand the transformation of using MFCA rather than conventional accounting method of Indonesian Business Entity; especially in this research was PT Semen Padang. The research hope can be useful by the Company especially to be considered in using the new accounting method for the next.

Second, this research tries to give a description about the environmental cost by displaying the information related to the Environmental Management Accounting. The information in term of report will show the company the total of environmental cost in the production process within a year 2010. Furthermore, this information hope can useful by the management to manage their cost to gain competitive advantage in the market completion, and also tries to minimize the activity that give direct or indirect impact to the environment. By that condition, the Company is suggested to find the alternative way for the next time to in using the raw material or any resources which are eco-friendly to the environment.

I.4. Scope of Research

The writer limits the scopes of this research which are;

1. The research only develop the Environmental Management Accounting (EMA) system, not EMA reporting. Thus, this research doesn't focus on Environmental Costing.
2. This research doesn't distribute environmental impact to the environmental domain. It only classifies the environmental-related costs.
3. The way to calculate the data using Material Flow Cost Accounting Method by identify and analyze the material loss during the production.
4. This research develops Environmental Management Accounting to determine Environmental Cost occurred in PT Semen Padang in year 2010.
5. The scope of data analysis focus on one month production report of Indarung II,III,IV,and V that accumulate to be one year .

I.5. Writing Systematic

The writing systematic of this research comprises five parts. The first chapter describes background, problem definition, research design, research purpose and benefit and also writing systematic. The theoretical framework of Design the Model of Environmental Management

Accounting based Material Flow Cost Accounting in PT Semen Padang are identify in the second chapter.

The research methodology including the research design, scope of the research, data gathering method and data analysis is discussing in the third chapter. The analysis of the research results and other factors that could influence the findings applied in the fourth. And the fifth part presents the conclusions, limitations and suggestions of this research.

CHAPTER II

THEORITICAL FRAMWORK

II.1. Previous Research

As the major tool in Environmental Management Accounting, the material Flow Cost Accounting becomes a compulsory for business entity. For the Environmental Management Accounting research has been held by many researchers before. This issue was recognizing earlier in overseas especially in Germany and Japan then in Indonesia. This issue was the development of the Material Flow Analysis where the concepts earlier for the material and energy balancing as introduced by Ayres (1978). The first material flow account on the national level have been presented at the beginning of the 1990s in Austria (Steurer, 1992) and Japan (Environmental Agency Japan, 1992). After the development of Environmental Issues, people use MFA in calculating the cost for Environmental Cost.

The original form of material flow cost accounting was developed in Germany by the Institut für Management und Umwelt (IMU) (Strobel and Redmann, 2002). Material flow cost accounting is a system which measures material flows (flows and stocks) in factories (or processes) in terms of physical amounts and monetary amounts. The remarkable point of this technique is that waste, which previously had been often measured in terms of weight alone, was now assessed by cost as well. In conventional cost accounting methods, emphasis is placed on the appropriate estimation of material input into the factory or process. How much of the input material costs are wasted in the course of manufacture is not important. This is because if the costs of raw materials which end up as waste were not added to product costs, the company would not make a profit. Therefore, in conventional cost accounting methods, even though it is possible to determine waste costs in terms of monetary amounts, the waste costs tend to be overlooked (Nakajima, 2006).

In his research in Kansai University Review of Business and Commerce, Nakajima (2006) also said MFCA which does not have such a limitation has been considered to be one of the small domains of management accounting where environmental management and management accounting have so far been integrated, but that as a result of the theoretical and practical development of MFCA, MFCA has expanded to cover most of the management accounting field. Nevertheless, because there has not been a set-up domain in management accounting from the beginning, MFCA would exist as a tool which evolves the existing management accounting to a new phase, and that new management accounting based on MFCA will evolve.

The MFCA its self was introduced in Japan 2000 and MFCA were used by an enterprise (Nitto Denko), more than 50 companies have carried out examination of trial introduction of MFCA in the last two/three years. Furthermore, the general purpose of the use of MFCA is for special cost studies at present, but some enterprise utilize it as a daily management tool or a management accounting information system. The researcher will short a view example of company in Japan that used MFCA already with the founding result latter.

The topic about Environmental Management Accounting had been developed before by Eka Dian Istiqamah (2010) that discussed about the developing of Environmental Management Accounting (EMA) in PT Nusantara Beta Farma. In this research, she explained about the component of material input used in production process that to be resulted as Product Output and Non-Product Output. The material Input its self going to be break down in what effect they are going to give affect direct or in-directly to the environment. In here, the design of the research using Matrix of Distribution of Environmental- Related costs by Environmental Domain. By that Matrix she knows how much cost that give impact to the environment. The Total Cost than compare with the total of Cost of Goods Sold by the Company, which so she knows how much the percentage of environmental affect it's self to the total cost. From that point, she has a finding that need to be suggested to the management to be improved and to be reduced.

II.2 .Material Flow Cost Accounting

Material Flow Cost Accounting, in a broad sense, is a system to measure the flows and stocks of materials in manufacturing process (raw materials and energy), in terms of physical and monetary units-identifies accurate costs of wastes and emissions (Ministry of Economics, Trading and Industry)

According to Organization For Economic Co- Operation and Development (OECD) MFCA is a tool for reducing the relative consumption or resources and material cost and can be applied in service industries as well as manufacture industries. MFCA is a major tool of Environmental Management Accounting and is oriented to internal used within in organization.

MFCA is a method that traces physical flows and stocks of materials in process, and then calculates their cost by multiplying material quantifies by unit price. MFCA highlights the cost generated by and/or associated with material losses (along with products costs) as accurately as possible. It is therefore useful for improving material efficiency by identifying opportunities to reduce their relative consumption of materials. MFCA not only aims to reduce environmental impact, but also pursues cost reduction via reducing the use of raw materials and the generations of wastes. Most environmental management tools, including environmental management systems such as ISO 14001, while effective in reducing environmental impact, do not make a clear contribution to corporate profits, but instead tend to generate an additional cost for companies, at least in the short term. However, since MFCA addresses this problem by reconciling the environment and the economy, it has produced notable results for many companies (see, for example, Kokubu and Nakajima, 2004; Viere et al., 2007; Wagner and Enzler, 2006 and Jasch, 2009).

According to Ministry of Economics, Trade and Industry, 2007;

"Material Flow Cost Accounting (hereafter referred to as "MFCA") is one of the environmental management accounting methods aimed to reduce both environmental impact and costs at the same time, as a tool of decision making by business executives and on-site managers. MFCA seeks to reduce costs through waste reduction, thereby improving business productivity. The prototype of MFCA was developed at the Institute of Management and the Environment (Institut fur Managementund Umbelt, IMU) in Augsburg, Germany. In Japan, MFCA are modified for increased facility of use, by segmenting materials into raw materials and energy sources, as well as measuring them by process for easier improvement plans."

MFCA measures the flow and stock of "materials," which include raw materials, parts and components in the manufacturing process, in terms of both physical and monetary units. The costs are managed in the categories of material cost, system cost, and transportation and waste treatment cost. You can identify the costs of loss by defective products, waste and other emissions, through calculating their quantities and the resources used in each manufacturing process and converting them into monetary value. In addition to the cost of raw materials, labor cost, depreciation cost and other processing cost are allocated under such loss cost, and waste cost is calculated by the same means as production cost. That is why waste is called "negative product" in MFCA.

An increasing number of businesses are introducing MFCA in Japan, for the following reasons.

1. MFCA helps businesses reduce the amount of waste generation itself, instead of expandingbwaste recycling.
2. Reduced waste generation directly leads to the reduction of material input and material cost, which realizes direct cost reduction.
3. This also leads to increased efficiency in processing and waste treatment operations, thereby enabling reduction of not only material cost but of manufacturing cost in general.
4. Reduction of waste generation and of material input (resource consumption) are one of the key activities in environmental management, to lower the environmental impact of manufacturing industry.

II.2.1. MFCA and its Significance, Economic Effects and Environmental Contribution

A business entity is required to make "environmental consideration" in diverse phases of its operations. Many companies are promoting environmental management of their business facilities and emissions from such facilities through manufacturing activities, promoting waste recycling and achieving zero emission.

Although waste recycling is one of the important measures for effective resource use, you must note that the recycling process also requires the input of substantial expenses and energy, in addition to those spent from the resource input to the waste generation. Therefore, it is essential to reduce waste generation itself. MFCA identifies the quantities and costs (incl. material, processing and waste treatment costs) of waste generated from each process of manufacturing activities. This enables us to look at the very source of waste generation and crystallize difficulties in its reduction, which leads to the reduction of waste generation itself.

Reduction of waste generation directly leads to reduced input of resources and enhanced environmental consideration in manufacturing process, as well as realizing slimming of resource procurement and increased efficiency of business operations. MFCA is an effective management tool that helps business management realizing the "harmony of environmental aspects and profitability", through simultaneous improvement of environmental consideration and cost reduction in manufacturing.

II. 2.2. Waste from manufacturing process = Material loss

In a processing-type manufacturing, waste and resource loss occur in various steps of the manufacturing process. Waste generated from processing includes the following.

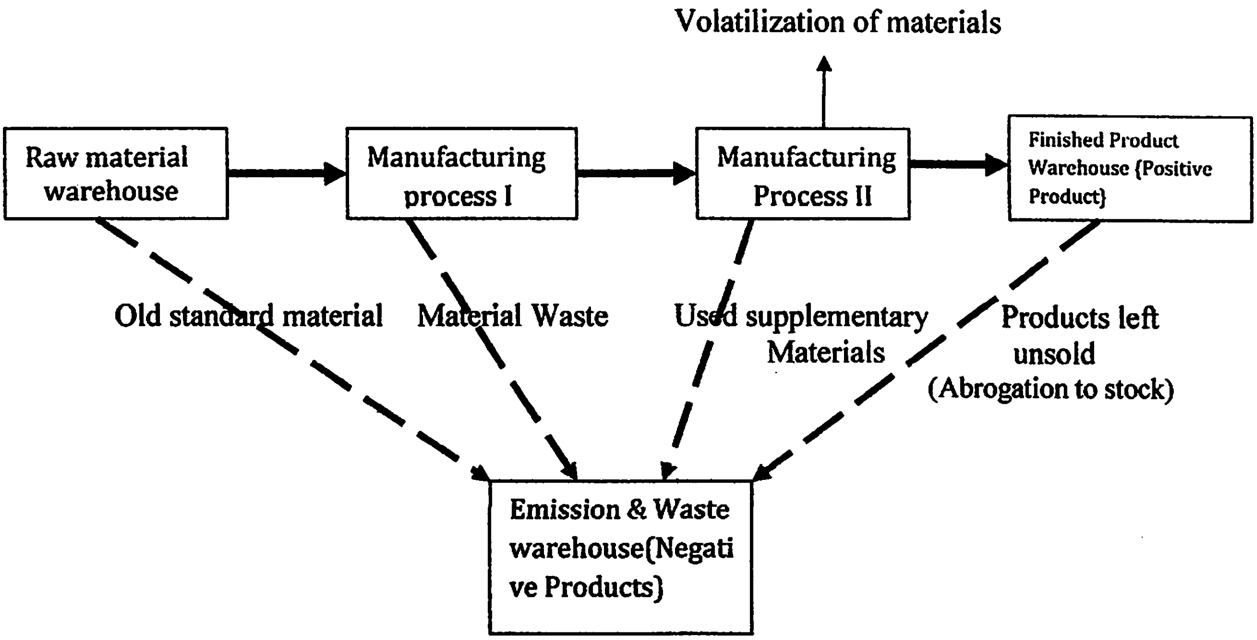
1. Material loss during processing (e.g. listing, swarf), defective products, impurities
2. Materials remaining in manufacturing equipment following set-ups
3. Auxiliary materials (e.g. solvents and other volatile materials, detergents to wash equipment before set-ups)
4. Raw materials, work-in-process and stock products discarded due to deterioration or other unusable reasons

MFCA traces equally the both flows of final products and emissions (wastes) in processes. And MFCA recognizes even the emissions as one product. MFCA calls products "positive products "and the emissions "negative products".

Now the question comes up from the people, what is the main difference between the Conventional Accounting Method with the New Environment tools called MFCA?

Comprehension of the difference between MFCA and conventional cost accounting (CCA) helps understand MFCA. MFCA traces material flows in physical unit and monetary unit, focusing strongly on material losses. One main difference between MFCA and CCA lies in the treatment of the costs of material losses and inefficiencies in processes. In CCA, all material costs and processing costs are assigned to product costs. Although material losses can be visibly recognized in CCA, the cost thereof is not separately identified. Waste management costs associated with material losses are either incorporated in product costs or hidden in overhead costs. This approach does not highlight the costs of material losses and inefficiencies in the process due to a lack of understanding of the comprehensive costs of material losses.

Michiyasu Nakajima," The new Management Accounting Field Established by Material Flow Cost Accounting (MFCA)" Kansai University Review (March 2006)pp.1-22 said in MFCA, if the subject of introduction is a production process, firstly a material flow figure of such manufacturing process as for example, Figure 1 will be prepared in detail and accurately, and then costs will be evaluated in accordance with the material flow information. In practice, the material flow and the amounts of costs towards "negative products", that will not become products in such manufacturing process will be calculated by totaling them by location and product together with the material flow and the amounts of cost of "positive products", which are good products. Then the calculation result of MFCA will be processed and provided as cost management information in a useful form that will be appropriate for the objective of management.



FigureII.1. Material Flow, and Positive and Negative Products

II.2.3. The Basic Cost Calculation Method of MFCA

MFCA quantifies material flows and stocks in process/processes in terms of both physical and monetary units. Here, a strict demarcation is required between material that forms part of the product, including intermediate product, and that portion of materials that ends up as waste to be discarded. In conventional cost accounting, it is of fundamental importance to determine whether or not the incurred cost in total is recovered from sales, and a strict determination of whether material is transformed into products, or thrown away as waste, is not generally required.

MFCA is based on the principle of quantifying the flows of materials at the point in the manufacturing process at which any material losses (wastes) are generated. In this calculation not only is the cost of the input materials included, but also processing costs such as labor costs and depreciation costs are allocated, both to products and material loss. This is because MFCA assumes that even for waste materials, processing has been applied and labor and equipment costs are thus involved. Waste is recognized as "another" product in this calculation. In addition to material costs and processing costs, waste disposal costs are therefore added to the cost of waste.

A simplified method for the calculation of MFCA is illustrated in Figure 1. In this example, one type of material (100kg) flows to both product (80kg) and waste (20kg). In a production process, which is a point for MFCA calculations, costs incurred are $1,000 for the material and $600 for processing. In conventional cost accounting, the cost of waste is generally not calculated. However, in MFCA the cost of the waste (material loss) is quantified as follows. First, the $1000 cost of the material is divided, according to the weight ratio between product and waste, into $800 and $200. Second also based on the weight ratio, 20% of the processing cost ($120) is allocated to the wastes. Thus, the total cost of the waste is $320.

As the calculation shows, we can define directly the new model used by the MFCA in Production Cost.

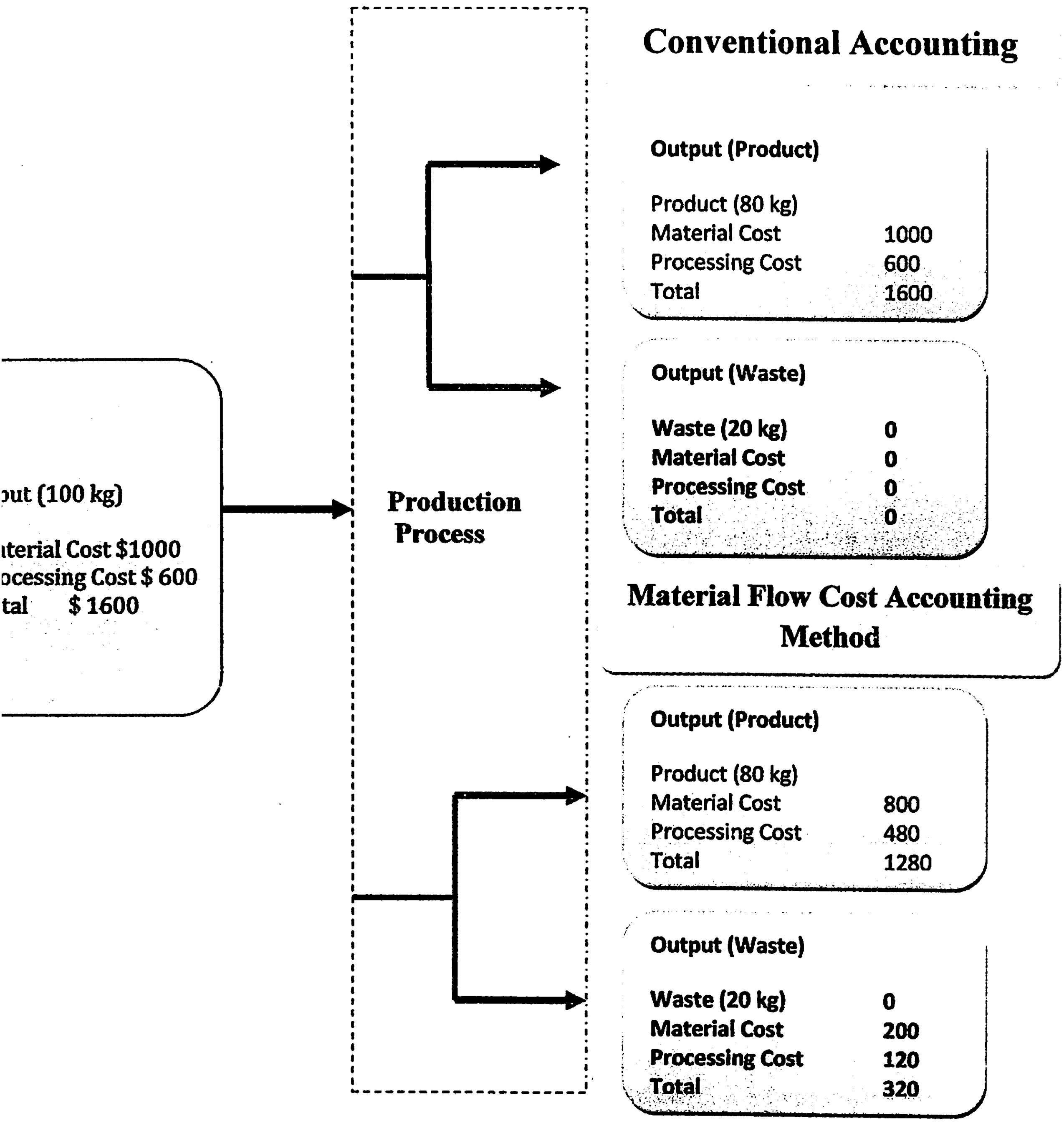


Figure II.2: Calculation of Material Flow Cost Accounting

Source: Environmental Management Accounting (Material Flow cost Accounting) METI, September 2007

In Figure 2, the important information is that the waste actually costs $320, to which waste management cost should be added in the final analysis of MFCA. In conventional cost accounting, the waste is understood simply as an object equivalent to 20kg, but MFCA clarifies that this object is also equivalent to $320. This implies that, not including waste disposal costs, $320 per product (20% of the total manufacturing cost) is wasted. MFCA provides such information to the management and motivates them to reduce waste substantially.

Since MFCA provides information on the basis of actual measurements, excluding the various premises involved in production processes, it sheds light on aspects that had been ignored by conventional management techniques where the management information provided was based on the premises of standard production processes. In practice, MFCA is expected to be effective in the following respects: investment appraisal in plant and equipment, modifications or substitution of raw materials, improvements in product design and production planning, and on-site improvement activities (Kokubu and Nakajima, 2004). For example, since MFCA makes it possible to accurately evaluate the cost of losses generated in manufacturing processes, this information can be used for the evaluation of new equipment or in substituting new raw materials in order to reduce losses. These are major aspects in which MFCA enables information to be used most efficiently.

From the calculation of production cost, we can also compare the Conventional method with the MFCA through Profit and loss statement.

Conventional P/L and the relevant cost accounting are unable to identify cost losses.

Cost losses are automatically identified as "negative product cost" in P/L based on MFCA, enabling clearer planning of cost reduction measures and improvement effects.

P/L based on conventional cost accounting (unit: thousand yen)	
Sales	2,500
Cost of conforming Products	1,600
	Unknown
	Unknown
Sales profit	900
Sales and general administrative expenses	400
Operating profit	500

P/L based on MFCA (unit: thousand yen)	
2,500	Sales
1,600	Cost of conforming products
1,280	Positive product cost
320	Negative product cost (loss cost)
900	Sales profit
400	Sales and general administrative expenses
500	Operating profit

Figure II.3: Comparison of Conventional Accounting Method with MFCA

Source: Environmental Management Accounting (Material Flow cost Accounting) METI, September 2007

As what explained, Material Flow Cost Accounting is one of the environmental management accounting methods aim to reduce both environmental impact and costs at the same time, as a tool of decision making by business executives and on- site managers. MFCA seeks to reduce costs through waste reduction, thereby improving business productivity. The prototype of MFCA was developed at the Institute of Management and the Environment (Institut fur Managementund Umbelt, IMU) in Augsburg, Germany. In Japan, MFCA are modified for increased facility of use, by segmenting materials into raw materials and energy sources, as well as measuring them by process for easier improvement plans.

MFCA measures the flow and stock of "materials," which include raw materials, parts and components in the manufacturing process, in terms of both physical and monetary units. The costs are managed in the categories of material cost, system cost, and transportation and waste treatment cost.

You can identify the costs of loss by defective products, waste and other emissions, through calculating their quantities and the resources used in each manufacturing process and Convert them into monetary value.

In addition to the cost of raw materials, labor cost, depreciation cost and other processing cost are allocated under such loss cost, and waste cost is calculated by the same means as production cost. That is why waste is called "negative product" in MFCA.

When we take a look, the position of MFCA it's self in Environment Management Accounting as follows;

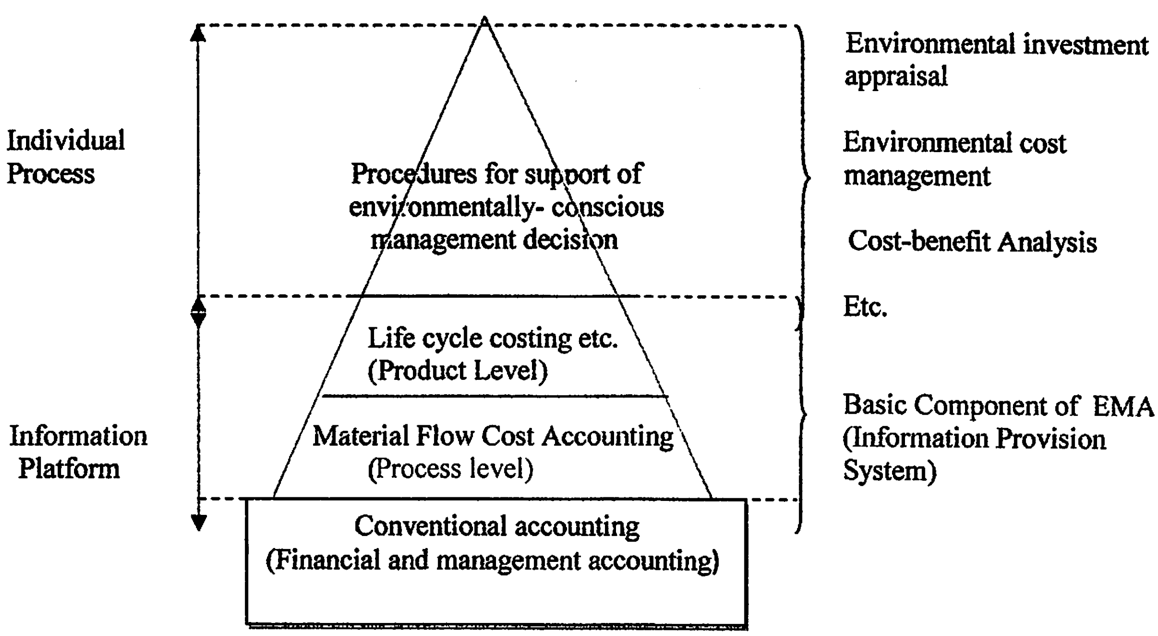


Figure II.4: The Positioning MFCA in EMA

(Source: Japan Industrial Standards Committee (JISC), June 2007 Beijing)

The position of MFCA in the EMA system can be presented as shown in Figure IV-4. While life cycle costing focuses on products beyond the boundary of an organization, MFCA targets mainly manufacturing processes within it. Therefore, when an organization is considered as a unit, MFCA would form more basic platform for EMA. In addition, while MFCA is completely independent from regulated accounting such as financial accounting, MFCA uses conventional accounting information, and therefore this tool can be also located as an interface between EMA and conventional accounting system.

From that stand point, we know that the material flow cost accounting is the process level. Implementing the MFCA is identifying each unit in the production to seek the value added and non-value added of activities that generate highly cost. MFCA trying to disclose the hidden cost happen that conventional accounting doesn't show.

II.3. Environmental Management Accounting Definition

Environmental Management Accounting has no single, universally accepted definition. According to IFAC's Statement Management Accounting Concepts, EMA is "the management of environmental and economic performance through the development and implementation of appropriate environment-related accounting systems and practices. While this may include reporting and auditing in some companies, environmental management accounting typically involves life-cycle costing, full-cost accounting, benefits assessment, and strategic planning for environmental management."

A complementary definition is given by the United Nations Expert Working Group on EMA which more distinctively highlights both the physical and monetary sides of EMA. This definition was developed by international consensus of the group members, representing 30+

nations. According to the UN group: EMA is broadly defined to be the identification, collection, analysis and use of two type's o information for internal decision making:

1. physical information on the use, flows and destinies of energy, water and materials (including wastes) and

2. Monetary information on environment-related costs, earnings and savings.

These two definitions highlight the broad types of information organizations typically consider under EMA, as well as some common EMA data analysis techniques and uses. The specific types of physical and monetary information included under this definition of EMA are discussed in more detail below and in subsequent chapters. The benefits and uses of EMA also are discussed in more detail below.

These two definitions highlight the broad types of information organizations typically consider under EMA, as well as some common EMA data analysis techniques and uses. The specific types of physical and monetary information included under this definition of EMA are discussed in more detail below and in subsequent chapters. The benefits and uses of EMA also are discussed in more detail below.

In the real world, EMA ranges from simple adjustments to existing accounting systems to more integrated EMA practices that link conventional physical and monetary information systems. But, regardless of structure and format, it is clear that both MA and EMA share many common goals. And it is to be hoped that EMA approaches eventually will support the IFAC proposals in

Management Accounting Concepts that, in leading-edge MA, "inattention to environmental or social concerns are likely to be judged ineffective," and that "resource use is judged effective if it optimizes value generation over the long run, with due regards to the externalities associated with an organization's activities."

II.3.1. Types of Information included under EMA

II.3.1.1. Physical Information under EMA

To assess costs correctly, an organization must collect not only monetary data but also non- monetary data on materials use, personnel hours and other cost drivers. EMA places a particular emphasis on materials and materials-driven costs because: (1) use of energy, water and materials, as well as the generation of waste and emissions, are directly related to many of the impacts organizations have on their environments and (2) materials purchase costs are a major cost driver in many organizations.

Most organizations purchase energy, water and other materials to support their activities. In a manufacturing setting, some of the purchased material is converted into a final product that is delivered to customers. Most manufacturing operations also produce waste – materials that were intended to go into final product but became waste instead because of product design issues, operating inefficiencies, quality issues, etc. Manufacturing operations also use energy, water and materials that are never intended to go into the final product but are necessary to manufacture the product (such as water to rinse out chemical tanks between product batches or fuel use for transport operations). Many of these materials eventually become waste streams that must be managed. Non-manufacturing operations (for example, agriculture and livestock, resource extraction sector, service sector, transport, the public sector) can also use a significant amount of energy, water and other materials to help run their operations, which, depending on how those materials are managed, can lead to a significant generation of waste and emissions.

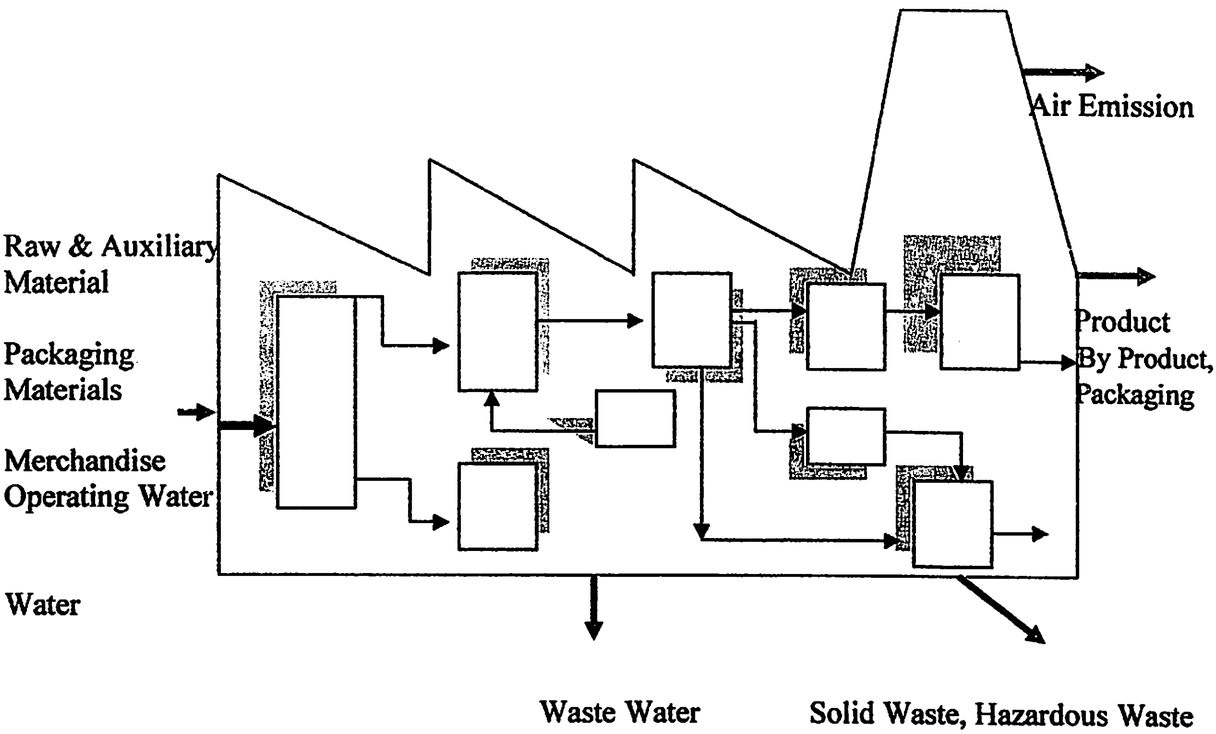
Thus, the most obvious example of materials-related environmental impacts is the generation of waste and emissions, which can affect the health of both humans and natural ecosystems, including plants and animals. Air, water or land can end up polluted or even contaminated.

II.3.1.1.1 Physical Information: Flow of Energy, Water, Materials and Wastes

In this part of material we should know about physical information in EMA, because it gives the type of physical information relevant under EMA in more detail and briefly discusses the related concepts of materials balances, materials flow accounting and environmental performance indicators, so we can determine the amount of cost flow in the process by classifying the type of cost categories.

Under the physical accounting side of EMA, an organization should try to track all physical inputs and outputs and ensure that no significant amounts of energy, water or other materials are unaccounted for. The accounting for all energy, water, materials and wastes flowing into and out of an organization is called a "materials balance," sometimes also referred to as "input-output balance," a "mass balance" or an "eco-balance." Many organizations perform energy balances and water balances separately from other materials balances. As this terminology implies, the underlying assumption is that all physical inputs must eventually become outputs – either physical products or waste and emissions –and the inputs and outputs must balance. The level of precision of a materials balance can vary, depending on the specific purposes of the information collection and the availability and quality of the data.

Figure2.5. Materials Flow Accounting



Source: Environmental Management Accounting (IFAC, August 2005)

Materials balances can take place at many different levels. The physical information can be collected for an entire organization, or for particular sites, input materials, waste streams, processes or equipment lines, product or service lines, etc., depending on the intended use of the information. Ideally, the materials balances done on more detailed levels would aggregate to match a materials balance done for a site or organization as a whole. In practice, however, materials balances at different levels often are not cross-checked and, therefore, are not consistent.

II.3.1.1.2. Quantification of the material flows in physical units

In each quantity centre, the amounts of inputs and outputs should be quantified in physical units such as mass, length, number of pieces, or volume, depending on the type of material. All physical units used should be convertible to a single standardized unit (e.g., mass) so that material balances can be conducted for each quantity centre.

A material balance requires that the total amount of outputs (products + material losses) is equal to the total amount of inputs, taking into account any inventory changes within the quantity centre. Ideally, all materials within the MFCA analysis boundary should be traced and quantified, but materials that have minimal environmental or financial significance can be omitted, at the discretion of the organization.

Materials Inputs are any energy, water or other materials that enter an organization. Outputs are any products, wastes or other materials that leave an organization. Any Output that is not a Product Output is by definition a Non-Product Output (NPO). In organizations that use energy and materials but do not manufacture physical products, such as transport or other service sector companies, all energy, water and other materials used will eventually leave as Non-Product Output, by definition. The remainder of this document will use the term NPO synonymously with the term "Waste and Emissions."

I. Materials Inputs

a. Raw and Auxiliary Materials

Raw and Auxiliary Materials are Materials Inputs that become part of an organization's final physical product or by-product. Raw Materials are the major product components (for example, the wood used in furniture manufacturing); Auxiliary Materials are the more minor product components (for example, the glue used in furniture manufacturing). Any water that becomes part of an organization's final product is covered separately in the "Water" category.

b. Packaging Materials

Packaging materials are Materials Inputs intended for use in shipping an organization's final products. These materials can be purchased in ready-to-use form, or may need to be processed on-site before being used.

c. Merchandise

Some businesses purchase items that are then directly sold again as products, with little or no additional processing. These Materials Inputs are categorized as merchandise. Example of environmental impacts/costs associated with merchandise include the impacts and costs of energy for storing and handling the merchandise or impacts and costs of disposal of merchandise (such as food) that that has outlived its useful shelf life. In such cases, merchandise materials and related costs should be tracked. Generally, however, since merchandise does not run through any kind of production line, there tend to be fewer environmental impacts and environment-related costs associated with an organization's handling of merchandise than with other input materials.

Thus, merchandise is not discussed in further detail in this guidance document.

d. Operating Materials

Operating Materials are Materials Inputs that an organization purchases and uses but do not become part of any physical product delivered to a customer. Examples include office supplies, building cleaning supplies, lighting fixtures, etc. For non-manufacturing organizations, most Materials Inputs will be these types of Operating Materials, for example, fuel for transport services. Manufacturing operations will use these types of Operating Materials as well as others, such as chemical catalysts, equipment cleaning solvents, etc. Because Operating Materials do not become part of any physical product, they automatically become a form of Non-Product Output (Waste and Emissions) when they leave the organization.

e. Water

The Water category includes all the water an organization uses, from all sources, such as rainwater, groundwater, surface water from rivers and lakes, regardless of how the water is obtained (for example, private wells or the public water supply system). In some manufacturing sectors, such as food processing, water may be part of the final physical product (much like Raw and Auxiliary Materials), while other water is never intended to go into a final product but is used for other purposes, such as cooling or cleaning (much like Operating Materials). Thus, some water may leave a manufacturing organization in the form of physical product, but the remainder will leave as Waste or Emissions.

In non-manufacturing organizations, all water used is much like an Operating Material. It does not go into a final product but is used as a support material and eventually leaves the organization as Waste or Emissions. An example would be the water used by a vehicle washing service, which eventually leaves the organization in the form of wastewater or evaporative emissions.

Water is in a separate category from other input materials because it is particularly important from an environmental perspective and because accounting systems often manage water flow information differently from other materials flow information.

f. Energy

The Energy category includes all the energy, of all types, an organization uses: electricity, gas, coal, fuel oil, district heating and cooling, biomass, solar, wind and water. In some manufacturing operations, Energy may sometimes be viewed as something that is incorporated into a final product (for example, via a chemical reaction) but, more often, Energy is viewed as an Operating Material, in that the Energy is never intended to become part of a physical product but is instead used for running equipment, etc. Non-manufacturing operations can also use a great deal of energy, such as equipment energy for resource extraction operations, fuel for transport service firms, and energy for building heating and cooling operations.

Energy is in a separate category from other input materials because it is particularly important from an environmental perspective and because accounting systems often manage energy flow information differently from other materials flow information.

II. Product Output

Outputs are any products, wastes or other materials that leave an organization. Product Outputs are physical products, by-products and associated packaging that are delivered to external customers. Definitions of the various Product Output categories are given below. Thus, this category is relevant only to organizations that produce a physical product, such as resource extractors or manufacturing operations.

a. Products (including packaging)

Products include any physical products, such as the computer chips produced by an electronics-manufacturing firm, including packaging.

b. By-products (including packaging)

By-products are minor products incidentally produced during the manufacture of the primary product. All by-products that result in earnings are considered, as well as associated by-product packaging. It is important to note that the boundaries between products, by-products and waste are not well defined in some companies, and depend partially on how well an organization separates by-products and waste.

III. Non-Product Outputs (Waste and Emissions)

Any Output that is not a Product Output is by definition a Non-Product Output (NPO). Examples include solid waste, hazardous waste, wastewater and air emissions – all defined further below. These Wastes and Emissions are generated in two ways. First, they are generated when Materials inputs that were intended to leave the facility in the form of Product Output become Waste and Emissions instead because of poor equipment efficiency and maintenance, inefficient operating practices, production losses, product spoilage, poor product design or other reasons. Materials Inputs that contribute to NPO in this way include Raw and Auxiliary Materials, Packaging Materials, Merchandise and sometimes Water. For all these, loss (scrap) percentages should be measured, calculated or estimated.

Waste and Emissions are also generated when Materials Inputs that were never intended to become part of Product Output leave an organization. Inputs that contribute to Waste and Emissions in this way are Operating Materials, Water and Energy.

Organizations in all sectors can generate Waste and Emissions – resource extraction, manufacturing, transport and other service sector operations. Waste and Emissions can result from continuous losses (for example, continuous heat loss from an un-insulated oven or continuous water leaks from an old storage tank), episodic losses (for example, scrap from a poor quality batch of product), or one-time losses (for example, an accidental spill of some kind), and can come from any part of an organization – inventory, manufacturing, building services, shipping, etc.

a. Solid Waste

Solid Waste is defined to be relatively non-hazardous waste in solid form, such as waste paper, plastic containers, food waste, non-hazardous solid scrap product, etc.

b. Hazardous Waste

Hazardous Waste is defined to be more hazardous waste materials in solid form (such as discarded batteries), liquid form (such as waste paint and solvents) or mixed form (such as wastewater treatment sludge). Depending on the context, "hazardous" could be defined as infectious, flammable, toxic or carcinogenic.

c. Wastewater

Wastewater is defined to be waste streams whose primary component is water but which also contain contaminants of some kind, such as high biological oxygen demand (BOD), total suspended solids (TSS), nutrients (such as phosphates), excess heat and toxic materials (such as solvents, pesticides or heavy metals).

d. Air Emissions

Air Emissions are air streams contaminated with problematic levels of pollutants. Examples of pollutants include energy combustion by-products, such as nitrogen oxides, sulfur dioxide, carbon monoxide, particulate matter consumed and volatile organic compounds, as well as other pollutants such as metal particulates. Air emissions can also include radiation, noise and heat.

II.3.1.2. Monetary Information: Environment-Related Costs and Earnings

Similar to the physical information collected under EMA, monetary data can be collected for an organization as a whole, or for particular sites, input materials, waste streams, process or equipment lines, product or service lines, depending on the intended use of the information (for example, investment appraisal, assessment of total annual costs or budgeting). Some organizations may wish to extend the system boundaries beyond their own operations to include monetary information from suppliers, customers and other elements of the supply chain, with Supply Chain Environmental Management in mind, or the product/service life cycle, with Life-cycle Assessment and Costing in mind.

II.3.1.2.1. Quantification of the material flows in monetary units

1. Materials Costs of Product Outputs

In many manufacturing companies, most Materials Inputs are eventually incorporated into physical products (including by-products and packaging). These have potential environmental impacts when they leave the manufacturer, for example, if a product leaches toxic materials after it has been disposed of in a landfill at the end of its useful life. In addition, the extraction of all natural resources has environmental impacts, such as ecosystem disturbance at the extraction site. Thus, the overall materials-related environmental impacts of a manufacturer's product during its life-cycle from materials extraction, manufacturing, use at the customer and final disposal may often outweigh the environmental impacts of the smaller amount of materials that leave as Waste and Emissions during production.

Therefore, this cost category includes the purchase costs of Materials Inputs that are converted into products, by-products and packaging. These cost data help an organization to cost-effectively manage the materials-related environmental impacts of its products. For example, it might consider replacing a toxic product ingredient with a less-toxic, cost-effective alternative. The physical accounting side of EMA provides the information on the amounts and flows of materials and products needed to assess such costs

2. .Materials Costs of Non-Product Outputs

Despite the fact that Product Outputs usually make up the biggest amount of physical outputs from manufacturing operations, the total NPO (Waste and Emissions generated in manufacturing) can still be quite large, costly and environmentally significant. In operations where there is no physical product, all Input Materials leave the organization as NPOs, by definition.

Therefore, this cost category includes the purchase costs of Materials Inputs converted into NPOs. Although many organizations may consider these costs to be related to efficiency or quality, they are also environment related because they help an organization to cost-effectively manage the environmental impacts of its Waste and Emissions. It might consider, for example, acquiring more efficient process equipment that generates less waste per unit product output. In fact, the Materials costs of Non-Product Outputs are often higher than the more familiar environmental protection costs covered in Categories 3 to 5.The physical accounting side of EMA provides the information on the amounts and flows of materials and wastes needed to assess these costs.

Not all types of waste and emissions can be reduced – some are probably inevitable – but it is clearly in the financial best interest of organizations to use as little materials, energy and water as possible in achieving their goals. Luckily, preventive and proactive environmental management that reduces the amount of waste generated, rather than just treating the waste once it is generated, can often reduce not only the purchase costs of materials lost as wastes, but also subsequent waste control and treatment costs. Thus, assessment of these costs also allows managers to better assess the potential monetary value of preventive environmental management.

For manufacturing operations, this cost category also includes the processing costs of Raw and Auxiliary Materials up to the point that that they are converted into Waste and Emissions. These processing costs are the proportion of equipment depreciation and labor costs that have been used to help generate Waste and Emissions rather than a final product.

3. Waste and Emission Control Costs

This category covers: the costs of handling, treating and disposing of the Waste and Emissions; remediation and compensation costs related to environmental damage; and any regulatory compliance costs related to Waste and Emission control.

4. Prevention and Other Environmental Management Costs

This category covers: the costs of preventive environmental management activities such as green purchasing, supply chain environmental management, cleaner production, extended producer responsibility, etc. It also includes costs for other environmental management activities such as environmental planning and systems (for example, environmental management systems), environmental measurement (for example, monitoring, performance auditing), environmental communication (for example, community group meetings, government lobbying, environmental reporting) and any other relevant costs (for example, financial support of environmental projects in the community).

5. Research and Development Costs

This category includes the costs of Research and Development activities on environment-related issues and initiatives. Examples are the costs of: research on the potential toxicity of raw materials, development of energy-efficient products and testing of new equipment designs with higher materials use efficiency.

6. Less Tangible Costs

This category includes both internal and external less tangible (difficult-to-quantify) costs that typically are not found in the organization's information systems but can be potentially significant. Examples of Less Tangible Costs related to the environment include: liability (such as legal judgments related to natural resource damage); future regulation (such as likely future costs of stricter regulation of greenhouse gas emissions); productivity (such as worker absenteeism due to pollution-related illness); image and stakeholder relations (such as, barriers to financing for projects with negative environmental components); and externalities (external effects on society, such as the loss of property values due to proximity to highly polluting factories).

II.4. Detailed Description of Cost Categories

II.4.1. Materials Costs of Product Outputs

MATERIALS PURCHASE COSTS

Organizations need to consider the purchase costs of the following Materials Inputs that become part of the final Product Outputs:

1. *Raw and Auxiliary Materials;*
2. *Packaging Materials;*
3. *Water.*

II.4.2. Materials Costs of Non-Product Outputs

This cost category covers the purchase costs of materials eventually converted into Non-Product Output (Waste and Emissions). These are the costs an organization incurs as Waste and Emissions are generated within its operations (the costs of treating or disposing of those Waste and Emissions are considered separately in a different cost category). The physical accounting side of EMA provides the information on the amounts and flows of materials needed to assess these costs.

MATERIALS PURCHASE COSTS OF NPO

Managers should consider the purchase costs of the following Materials Inputs that become part of the NPOs.

1. Raw and auxiliary Material
2. Packaging Material
3. Operating Material
4. Water, and
5. Energy

II.4.3. Waste and Control Emission Cost

This category deals with the costs of controlling and treating all forms of Waste and Emissions once they have been generated – solid waste, hazardous waste, wastewater and air e missions. Waste and Emission control activities include: equipment maintenance; internal waste handling; waste and emission treatment; off-site recycling; waste disposal; remediation of contaminated sites and other pollution clean-up; and any environmental regulatory compliance costs related to generated waste or emissions. It is in the best interest of an organization to try and minimize these costs while still maintaining a high level of environmental performance.

This category does not include environmental management activities intended to prevent the generation of Waste and Emissions in the first place. Such activities are covered under the next cost category. It does include costs for:

1. Equipment Depreciation
2. Operating Materials
3. Water and Energy
4. External Services
5. Fees, Taxes and Permits
6. Fines
7. Insurance, and
8. Remediation and Compensation

II.4.4. Prevention and other Environmental Management Costs

This category deals with the costs associated with efforts to prevent the generation of Waste and Emissions and to implement other general environmental management activities not directly related to Waste and Emissions Control. First of all, it includes the costs of preventive environmental management activities, such as proactive eco-system management, on-site recycling, cleaner production, green purchasing, supply chain environmental management and extended producer responsibility. It also includes costs for more general environmental management activities such as: environmental planning and systems (environmental management systems, environmental financial accounting, environmental management accounting); environmental measurement (monitoring, performance auditing, performance evaluation); environmental communication (performance reporting, community group meetings, government lobbying) and any other relevant activities (such as financial support of environmental projects in the community).

This category includes costs for:

1. Equipment Depreciation;
2. Operating Materials, Water and Energy
3. Internal Personnel;
4. External Services; and
5. Other Costs.

II.4.5. Research and Development Costs

This category includes the costs of Research and Development activities involving environment related issues and initiatives. Examples are the costs of: research on the potential toxicity of raw materials; development of energy-efficient products; and testing of new equipment designs with higher materials use efficiency. Research and Development costs related to the environment might include costs of all kinds, such as those for equipment depreciation, operating materials, water and energy, internal personnel and external services.

Research and Development costs have a special category because they are sometimes substantial in comparison to other environment-related costs and can distort environment-related cost comparisons from year to year or between multiple sites owned by the same organization. In addition, some national statistical reporting schemes require businesses to report Research and Development costs as a separate category. In many organizations, Research and Development is a separate department with its own cost center. Although environment-related costs can be identified there, an organization will need to determine which Research and Development costs is actually environment related and which are not.

II.4.6. Less Tangible Costs

All costs in the previous categories are theoretically available somewhere in an organizations' accounting and information management systems. Accounting and other staff will need to collaborate on identifying them and then manually check data accuracy, consistency and completeness. The nature of Less Tangible Costs is different. These types of costs (and benefits) usually cannot be found anywhere in an organization's collective information systems

CHAPTER III

RESEARCH METHOD

III.1 Research Design

This research is qualitative research in term of case study that have aim to design the use of Material Flow Cost Accounting to manufacturing Company, specifically PT Semen Padang. The design of this report was derived from Environmental Management Reporting. Is it sufficient? For derivation of Material Flow Analysis of Accounting, this study used International Federations of Accountants (IFAC) _Guidance.

III.2. Variable

1. Physical side of EMA, Which include
    a. Material Input (raw and auxiliary material, packaging material, merchandise materials, water and energy
    b. Product Outputs (Products, By products, packaging)
    c. Non Product output (solid waste, hazardous waste, wastewater and air emissions)

2. Monetary Side of EMA, which includes;

1. Materials Costs of Product Outputs

Include the *purchase costs* of natural resources such as water and other materials that are converted into products, by-products and packaging.

2. Materials Costs of Non-Product Outputs

Include the *purchase (and sometimes processing)* costs of energy, water and other materials that become Non-Product Output (Waste and Emissions).

3. Waste and Emission Control Costs

Include costs for: *handling, treatment and disposal* of Waste and Emissions; *remediation and compensation costs* related to environmental damage; and any control-related *regulatory compliance costs.*

4. Prevention and Other Environmental Management Costs

Include the costs of *preventive environmental management activities* such as cleaner production projects. Also includes costs for *other environmental management activities* such as environmental planning and systems, environmental measurement, environmental communication and any other relevant activities.

5. Research and Development Costs

Includes the costs for *Research and Development* projects related to environmental issues.

6. Less Tangible Costs

Include *both internal and external costs* related to less tangible issues. Example Include *liability, future regulations, productivity, company image, stakeholder relations and externalities.*

III.3. Type of Data

The data can be obtained from primary or secondary data. Primary data refer to information obtained first hand by the researcher on the variables of interest for the specific purpose of the study. Secondary data is collected from the financial report of PT Semen Padang. As guidance, the author also used the books, accounting journal, and researches about Environmental Management Accounting.

III.4. Data Gathering Method

In order to get Information that appropriate to research objective, researcher is willing to use some method which think suitable to the data needed.

1. **Interview**

   One method of collecting data is to interview respondents to obtain information on the issues of interest. Interview could be unstructured or structured, and conducted either face to face or by telephone or online. For this research, the writer is willing to use Structured Interviews. This Interview method is conducted to the parties who responsible and take a apart on the Production Department and Accounting Department that conducted face to face, directly come to the Company and ask with a list of predetermined questions to be asked of the respondents either personally.

2. **Observation**

   Observation is the technique in finding the data by comes directly to the object research by participating in measuring or preparing the environmental cost or just discuss and brain storming with the person who in charge.

3. **Documentation**

   Because this research related with the "flow of the activities", the writer consider that documenting such kind of file such as Picture or video recording needed in completing the appropriate research.

This filed study method is not still enough to generate the sufficient data. Therefore, writer also use data of study of literature review based on IFAC Guidance about Environmental Management Accounting and another Principal and Procedural which developed of other Parties such as The Ministry of Economies, Trade and Industry of Japan and OECD Working Group on

Environmental Information and Outlooks (WGEIO) that discuss about Special Session On Material Flow Accounting (Paris, 24 October 2000).

However, this research conducted by direct observation to the company and interviewing the management of PT Semen Padang, especially management of Department of Production, Department of Accounting and Department of K3LH. This interview is aimed to understand the material flow, production process, cost generated and environmental treatment for the waste and gas emission.

Table III-1

List of Primary Data Collection Process

No.	Date	Person	Topic	Times
1	02-may-2011, 28-may-2011, 10-july-2011	Arini Kasmira,SE (Head of Cost accounting Bureau of Accounting Department)	Explore the production process and cost assigned to the raw material used.	30 Minutes
2	14-may-2011, 15-may-2011, 20-june-2011, 23-june2011,	Ellya Widhiatanti, S.Kom (planing and controlling bureu of Production department)	Explore the production process and material usage in one time production, and then the gas emission produced during the production	30 minutes

3	02-june-2011, 08-june-2011, 05-july-2011	Mulya Andhika Putra,ST, (Head of Environmental Department)	Explaining the effort and treatment of the environmental damage. The system and controller of gas emission	30 Minutes

III.5. Calculation Process

This research makes some calculation to get the result of material loss and environmental cost;

I. Material Loss

a) Calculate the material loss (raw material) in each process by multiplying the percentage of material loss with the total material available in the warehouse.

b) Calculate the positive product output in the year of 2010 by deduct the material purchase cost with the negative product output

II. Environmental Cost

a) Calculate each of the raw material cost for one month (December) of product output and non product output, and then accumulate to be one year.

b) Calculate the energy cost (fuel, coal, and electricity) for one month (December) of product output and non product output, and then accumulate to be one year.

c) Calculate packaging material for one year consumption.

d) Calculate the depreciation cost of machine in Indarung II/III/IV and V.

e) Calculate the operating material cost needed by the employee

f) Calculate the salary of the employee in charge of operating machine to control environmental impact

g) Record the compensation and remediation cost that PT Semen Padang pay for.

III.5. Data Analysis

To complete the research process, author may be willing to do several steps in analyzing the data:

III.5.1. Identify the current accounting system of PT Semen Padang

III.5.2. Identify the physical information in developing EMA based MFCA in PT Semen Padang

a) Identify the production process of Cement

b) Identify the material loss during the production process

c) Identify the material Inputs used in Producing Cement

d) Identify the Outputs and Efforts of PT Semen Padang to control and treat the outputs.

III.5.3. Identify monetary Information in developing EMA (MFCA based) in PT Semen Padang

a. Reporting Environmental Cost Method

III.5.4. Preparing the Environmental Report using the Environmental related cost categories.

Distribution of Environment-related cost by Environmental Domain

IRONMENTAL IAINS IRONMENT-RELATED T CATEGORIES	Air and Climate	Waste water	Waste	Soil, Ground Water	Noise and vibration	Biodiversity and Landscape	Radiation	Other	Total
laterials costs Of Product outputs									
aw and Auxiliary Materials									
ickaging Materials									
'ater									
laterials Costs Of Non-roduct Outputs									
Raw and Auxiliary Materials									
Packaging Materials									
Operating Materials									
Water									
Energy									
Processing Costs									
ASTE And EMISSION NTROL COSTS									
Equipment Depreciation									
Operating Materials									
Water and Energy									
Internal Personnel									
External Services									
Fees, Taxes and Permits									
Fines									
Insurance									
Remediation and Compensation									
'eventive And Other ronmental Management s									
Equipment Depreciation									
Operating Materials, Water, Energy									
Internal Personnel									
External Services									
Other									
ESEARCH and DEVELOPMENT TS									
ESS TANGIBLE COSTS									

Table III.2: Environmental Domain related cost categories

Source: Environmental Management Accounting (IFAC, August 2005)

Based on Table 3.1 the process of production should relate into the 9 of cost categories as a measurement and 6 cost domain in determine Cost Component regarding Environmental Cost.

III.5.5. Analyzing the Environmental Report. The information of the Environmental Management Accounting report of each component will represent which component of material contributes of higher cost. The component that has big cost will be the focus short of the management in improving the efficiency.

III.5.4. Manage the cost of Material flow accounting analysis will gain the competitive advantage. Material flow analysis is gotten by doing the *cost of product output analysis* and *cost of non-product output analysis.* By doing that, we can identify the cost trace to each component in the process and manage them.

III.6. Research Design

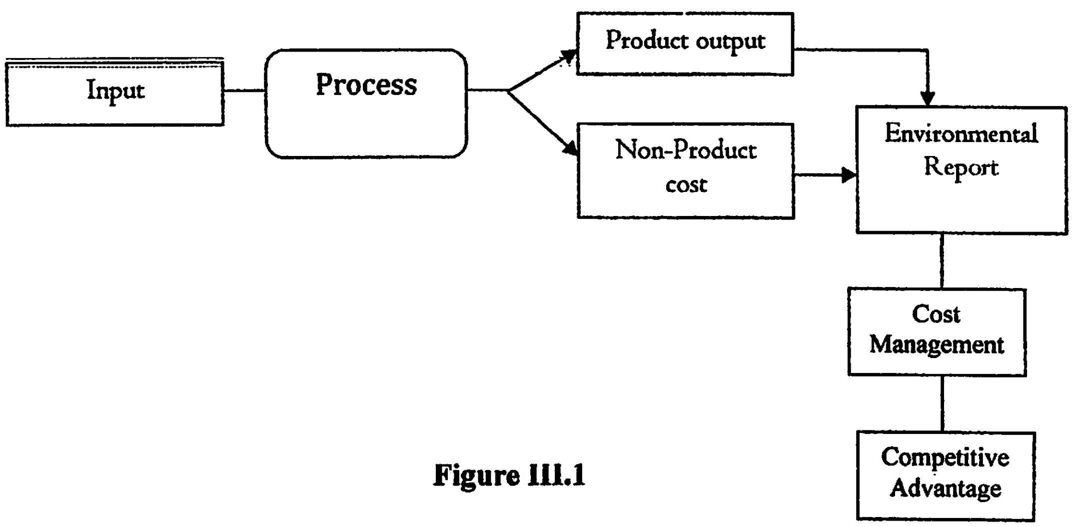


Figure III.1

Research Framework

CHAPTER IV

DISCUSSION AND ANALYSIS

IV.1. Company Profile

IV.1.1. Brief History of PT Semen Padang

The history of Indonesia cement industry originated from West Sumatra, commenced by the construction of Semen Padang in Indarung Padang, in 1910. The Government of the Republic Indonesia on July 5, 1958 nationalized bearing the name of NV Neverlansche Indische Portland Cement Maatschappij, the oldest cement plant in the Archipelago. Later, through its shares acquisition, Semen Padang becomes a member of PT Semen Gresik (Persero) Tbk since September 5, 1995.

Having high technical ability, Semen Padang has been the first cement producer in Indonesia awarded the API Q 1 & API Spec 10A Certification in 1985. In addition, the Company also obtained the European Certification for production of low alkaline cement. The high commitment of Semen Padang towards quality management of international standard was among others proved by the ISO 9002 Certification awarded in 1995 and ISO 9001 Certification awarded in 1994 that was upgraded into ISO 9001: 2000 Certification in 2003. Other certification that have been acquired are : ISO 14001:1996 certification in 1999 that was further upgraded into ISO 14001:2004 Certification in 2005, SMK3 Certification in 2002 and OHSAS 18001 in 2004, SNI 17025 Certification in 2005 and ISPS Code Certification in 2005.

At present, as integrated cement producer, Semen Padang has an annual production capacity of over five million tons of clinker and cement. The Company's main product from five plants in Indarung,Padang, is Portland Cement (PC) Type I.

Production Capacity

Plant	Capacity
Indarrung-II	**660.000 Ton**
Indarung – III	**660.000 Ton**
Indarung-IV	**1.620.000 Ton**
Indarung-V	**2.300.000 Ton**
Total	**5.240.000 Ton**

PT Semen Padang is well-known as a special type cement producer in Indonesia offering wide-ranging type of cement. Type of products:

1. Portland Cement Type I (*Ordinary Portland Cement*)
2. Portland Cement Type II(*Moderate Cement Type Ii*)
3. Portland Cement Type III (*High Early Strength Cement*)
4. Portland Cement Type IV (*High Sulfate Resistance*)
5. Super Masonry Cement (Smc)
6. Portland Composite Cement (Pcc)
7. Portland Pozzolan Cement (Ppc)
8. Oil Well Cement (Class G-Hsr)

The Traditional market of Semen Padang is in West Sumatra and other provinces in Sumatera. However, the Company also ships its products to West Java, Banten, Jakarta and Central Java, and Kalimantan. In addition, the Company also exports some products, among others to Bangladesh, Ceylon, the Middle East, Africa, Madagascar and Germany.

The company is prioritizing to establish a warm relationship with its distributions, sales agents and costumers, for both national and international markets, as well as to continue to enhance customer service. To ensure timely delivery of a continuous supply of products to its customers, the company is committed to continually enhance its system services and effectively manage its network of distribution facilities which include packing plants, buffer warehouse and wharfs that are supported by the ample availability of land and sea transportation armadas. In 2007, 68 % of cement was distributed by ships and 25% was exported. This achievement is supported by the continuing synergies with the Semen Gresik Group (SGG) that the company's brand, marketing network and internal business process is strengthened to meet the demands of Sumatra, Java, and International markets, ensuring the company can continue to grow.

The company is 99.99 % owned by PT Semen Gresik Tbk, with the remaining 0.01% in the hands of the Semen Padang employee Cooperative. The Semen Gresik Group (SGG) is currently owned by the Indonesian government with 51.01 % share, Blue Valley Holdings Pte. Ltd with 24.09 % share and the balance of 24.09 % in the hands of the public.

Semen Padang shareholders:

Shareholders	**Issued capital and fully paid up**	**Percentage**	**Total**
	Share	**%**	**Rp 000**
PT Semen Gresik (Persero) Tbk	332.000.000	99.99%	332.000.000
Koperasi Keluarga Besar Semen Padang	1	0.01	1
Total	332.000.001	100,00	332.000.001

The Company also has subsidiaries within the industry that includes PT Igasar (12% shareholder ownership), PT Sepatim Batamtama (85%), PT Bima Sepaja Abadi (80%), and PT Sumatra Utara Perkasa Semen (10%). PT Semen Padang also has interests within a number of supporting organizations, such as the Semen Padang Pension Fund, the Igasar Foundation, the Semen Padang Family Cooperative, the Semen Padang Hospital Foundation, PT Pasoka Sumber Karya and PT Yasiga Sarana Utama. Through its subsidiaries, Semen Padang involves in the business of packaging, distributing/transporting cement, and cement trading. In addition, through its R&D Department, the Company also offers enginerring services, industrial equipment, and other products.

Subsidiaries Companies

Name of Company	**Semen Padang Shares**
PT Sematim Batamtama	85%
PT Bima Sepaja Abadi	80%
PT Igasar	12%
PT Sumatera Utara Perkasa Sement	10%

IV.1.2. Company's Vision and Mission

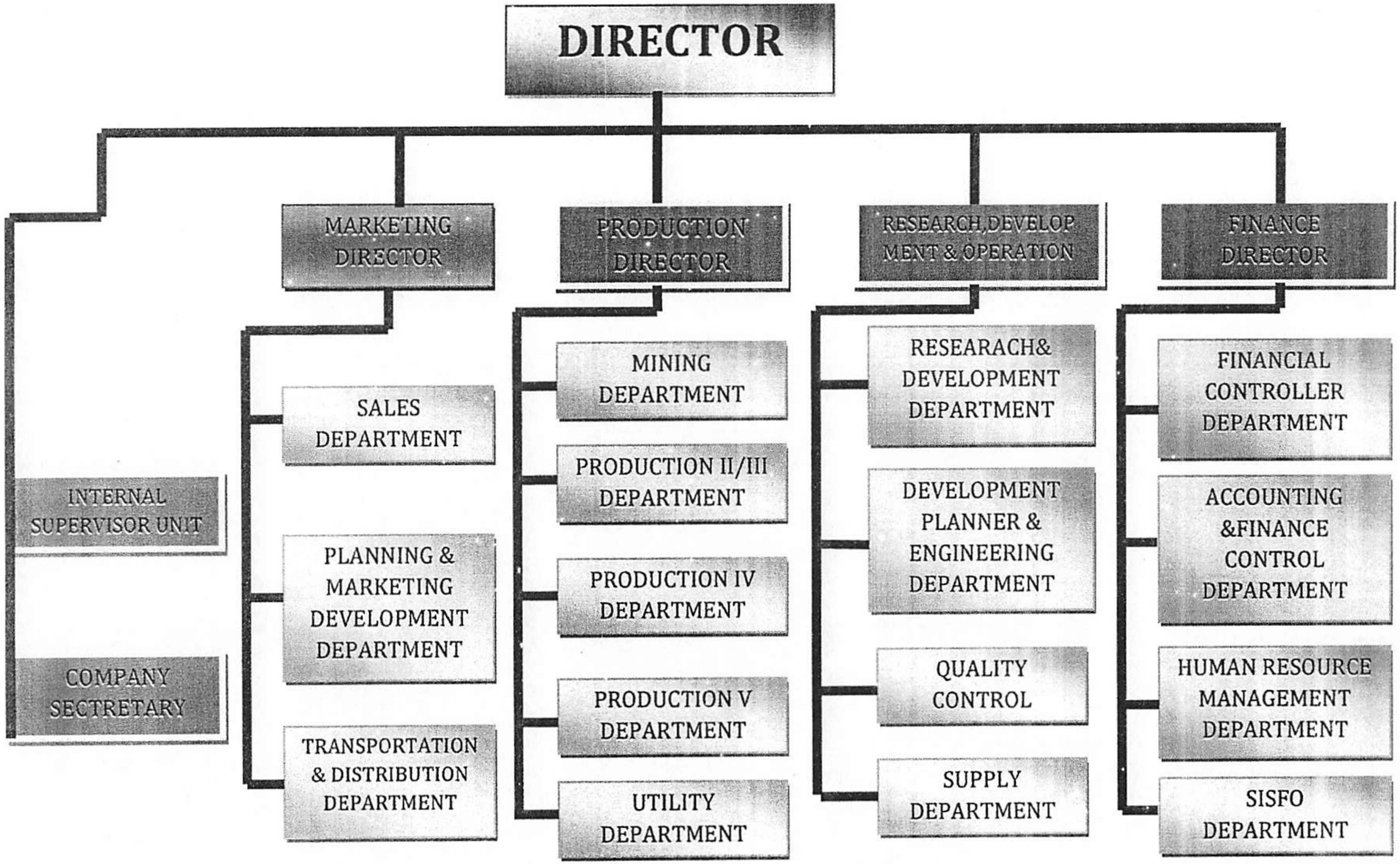
Vision

To become a reliable, excellent and eco-friendly cement company.

Mission

- To improve the Company's value for the stakeholders, to grow and to provide the best services to the customers.
- To develop an environmentally conscious industry.
- To develop competent and professional human resources.

IV.1.3. The Organizational Structure-Figure IV-1



IV.2. Design Model of Environmental Management Accounting use Material Flow Cost Accounting Approach

IV.2.1. Analyze the current accounting system used by PT Semen Padang

From identifying the Income statement of PT Semen Padang, the way to present it still uses the conventional system. Thus, the conventional accounting just show broad information without specifying environmental cost and it is not sufficient enough to support the management in make an excellent decision.

The material losses that happen during the production not recorded as it should be. Hence, from the report the Raw material, Labor, and Overhead, the cost often tend to "hide" the material loss that impact to the material directly or indirectly to the environmental cost.

IV.2.2. Identify the Physical Information in developing the model of Environmental Management Accounting in PT Semen Padang

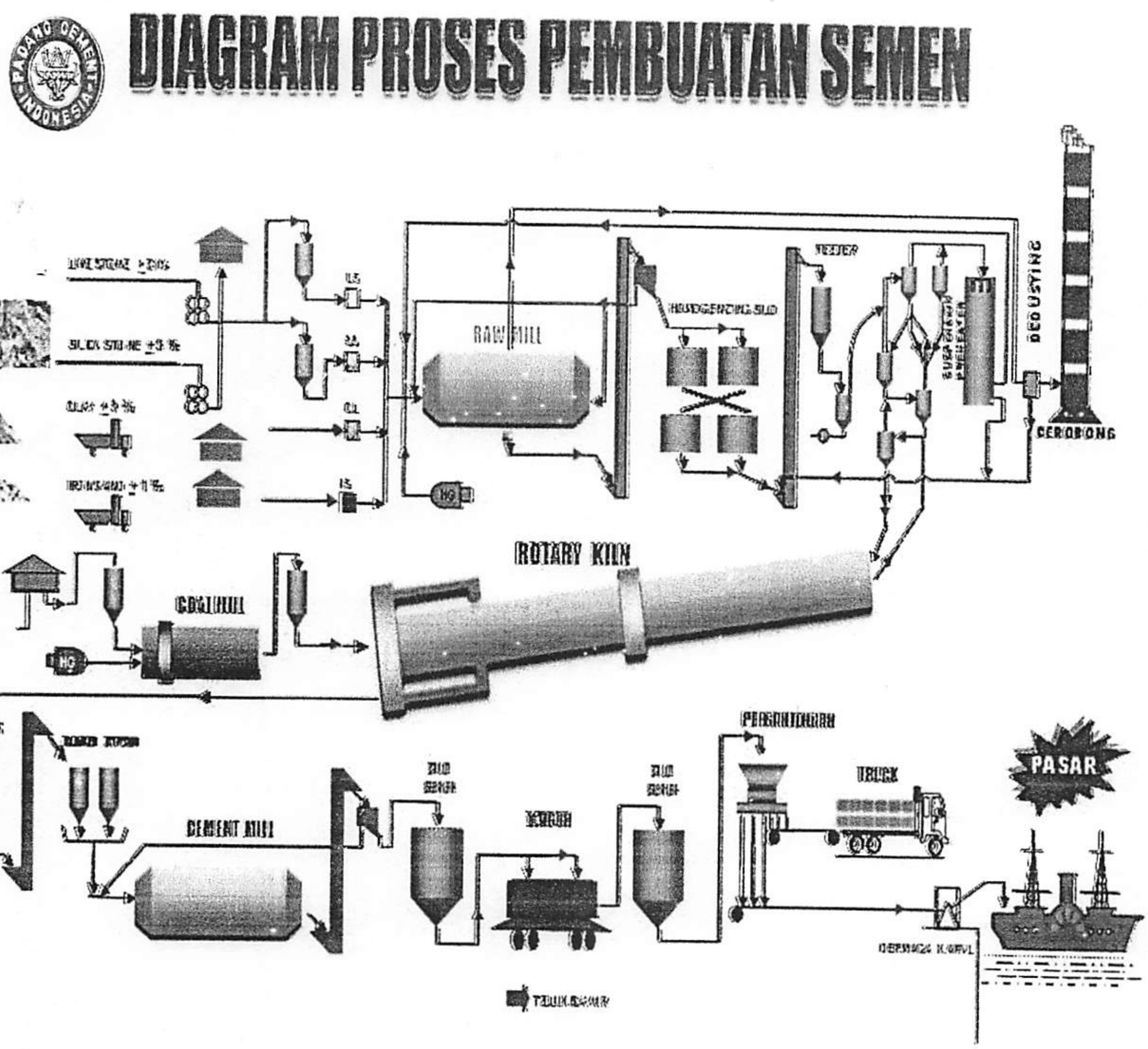
IV.2.2.1. Identify Production Process of PT Semen Padang

PT Semen Padang is one of the cement business based in west Sumatra. Manufactures Cements;

1. **Portland Cement Type I** (*Ordinary Portland Cement*)
2. **Portland Cement Type II** (*Moderate Cement Type Ii*)
3. **Portland Cement Type III** (*High Early Strength Cement*)
4. **Portland Cement Type IV** (*High Sulfate Resistance*)
5. **Super Masonry Cement** (Smc)
6. **Portland Composite Cement** (Pcc)
7. **Portland Pozzolan Cement** (Ppc)
8. **Oil Well Cement** (Class G-HSR)

Among the 8 kinds of Cement produced by PT Semen Padang, the Portland Cement Type I is the superior product.

The Business itself has net profit of approaching less more Rp. 1 trilliun and employs 2000 employee. The factory is located 15 km from the central city, so it far from the crowded to minimize the air pollution impact to the society as a whole.The process of manufacturing Cement that become the focus in this research can be seen in *Figure IV-1*.



Picture IV-1 : Cement Making Proses

(Source : PT Semen Padang)

There are two kind of production process in making Cement, Wet Process and Dry Process. Since the Indarung I factory closed, the wet process is not applicable anymore. Flow diagram for both process are shown below:

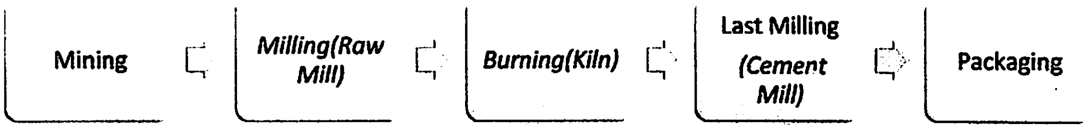


Figure IV-2. Production Process of Cement

Description:

1. **Mining and storing the raw material**
2. **Milling and Mixing of raw material, homogenization of mixing raw material.**
3. **Burning**
4. **Last Hulling**
5. **Packaging**

After the exploration of the raw material that explained in the material input subtopic, the next process is;

2. Milling and Mixing

In this step, raw material which prepared in a specific composition is milled till the material is smooth in certain level. This process is conducted in *raw mill* and *soil tromol.* The process of mulling it's self contains of two; dry milling and wet milling. Basically, these two processes differentiate of making cement.

a. Wet Milling

The mixing of raw material is milled in *raw mill* by adding a few of water in a certain amount, commonly 30%-40%. The mixing is conducted using *grinding media*, which is the balls steel with 30mm-90mm diameter. The mill will rotate, so the material and grinding will crush. The mixing of raw material that informs liquid now from the raw mill is called as *slurry*. In order the produced slurry is homogeny, so the technicians are homogenize the slurry by stirring up the material mechanically or use the boiler air in the patch bucket.

b. Dry Milling

In this process, the material that will milled will drying till the water contains in the material met in a certain scale. Drying may conduct before the milling (*drying and grinding*) or in the process of milling the raw material (*drying during grinding*). To drying, use the hot gas that produced from *kiln,* or from the hot produced by diesel or the hot get from the tool called *hot air generator*. The mixing of the raw material that before processed contain of 6-11% water after the milling become ± 0, 8%. This powder material compulsory said as *raw mix (raw meal)*.

3. Burning

The main objective of the burning is to produce the chemistry reaction and the forming of oxide compounding that contained in raw mater itself. The burning is done with maximum is 1400°C temperature. In the burning process are happen some steps;

- *Drying (for wet process)*
- *Pre-heating*

- *Calcinations*
- *Sintering*
- *Cooling*

The burning is conducted in a tool called *a kiln.* This kiln is cylinder with 5 meter diameter and length till 80 meter with 3° slope. This kiln is lined with anti-fire stone with height of 20 meter because its sel only the common steel. This kiln is rotate along the burning process in order the material are fairly burned. The fuel of this burning is *coal* that process become a *fine coal.* Raw meal and slurry that already sintered in the kiln will be cooling down in *cooler.* Now, the material resulted by the kiln called *clinker* with 140°C.

4. Last Milling

In this stage, the clinker that has cooled in silo is feed with gypsum into cement mill. In cement mill, the clinker 1 – 40 mm^3 milled with gypsum till meet a certain smoothness using a grinding media from a ball steel. The produced cements subsequently are store to the cement silo which ready to be packaged and transported. Quality and Quality control of cement is conducted in laboratories with X-ray using computer quality control.

5. Packaging

The process of packaging is conducted based on the number of distribution need. So there is no cement stored and special warehouse to accommodate the cement in this factory. The cement taken from Silo directly moves to packaging unit transporting by *air slide conveyor.* After packaged, the cement carried using belt conveyor over the truck. There are *eight* of *packer* unit in PT Semen Padang, 2 units in Indarung I, 6 unit in PPI, 4 unit in PPTB (one unit is rotary packer, with capacity 80.000 kg per hour).

IV.2.2.2. Identify the Material Loss during Production Process

The raw materials, auxiliary materials, and operating materials in the target process of being analysis will be described as follows;

First, from the starting process of blasting limestone in Bukit Karang Putih, The dynamite that exploded will result a piece of limestone. The Impact are destroying the ecosystem around, chemical effect to the ground, and the pieces of materials will not completely collected since all the small pieces of limestone can't be collected using the dozer. Then, the formatted size of limestone will deliver to the storage of the PT Semen Padang. In the journey process, there are material losses in the way to the storage because the texture of way is not smooth that caused the fallen of that material its self. The amount of losses is 6.5 % of the total ton of limestone and 5 % of silica stone.

Second, the material in the storage will deliver in the silo to be milled in raw mill. In raw mill it's self, the very tiny of limestone and silica stone that can't be transferred to the kiln process. The very tiny of raw materials will exclude from the chimney with the smoke of kiln process collectively. Those material actually filtered by the EP, but from 24 hours of active EP, there are a time that EP will not 100 % perform well. The operator turn down the speed of EP till 50%, that's why the dust exploded from the chimney will goes very solid. The amount is equally 7 %.

Third, the output of raw mill called raw mix posted to be burned in the Kiln. Kiln use Coal as the primary fuel and diesel fuel to add the heat. In the process of gathering coal, PT

Semen Padang buys it from Mining Coal Industry Sawahlunto Sijunjuang. The amounts of coal bought depend on the need of PT Semen Padang. Occasionally, the coal transferred from the supplier can't fulfill the Kcal of Coal it's self. Example; the Period I delivered get 6000 Kcal of coal from the 7000 Kcal, the Company should add another Coal. This is not calculated with the weight, but the heat can produce. This is because less quality of coal it's self. In this point, the management of Coal mill must be aware and taking care with the coal sent by the supplier. So, it this process there are 7% calculated as loss. 7 % of total fund prepared defined as loss. This point need to be improved; quality assurance of coal mill.

In Burning of raw mix, again of tiny material will exhaust as the dust, and some of materials will adhere to the wall of kiln. The amount calculated as 7%-7.2%. In this point, the management who in charge of the equipment and machine should increase and optimize the function of the Kiln, so the amount of Material patch to the wall and grinding media in the kiln may reduce.

Forth, the clinker as the result of raw mix burned in the Kiln will have milled again to get a certain smooth of cement mill. In this process, the cement mill will mixed with pozzoland if needed. The amounts of this auxiliary material depend on the need. In this process the material loss estimated as 7 % because of the patch of cement mill to the wall of raw mill.

Fifth, the finished product as Cement will store to silo that ready to be distributed. In this process the cement that store to the silo will put in to the truck. There are two models; the packaged cement and non-packaged cement (Semen Curah). In this process, there are material losses for 5 % of the total finished product. The employee will put the paper or packaging in the filling up machine, then the machine will fill the paper with the cement and put that in such place shelf. The packaged cement will bring into the truck, ready to be shipped. There are possibilities of human error in here, the bad quality of paper, and other factor that make the packed cement broke. The material losses of 5 % come from here. Then, the scrap of the paper will throw away. In this situation, the packing plan manager should minimize the human error and improve the packaging technology to minimize the loss.

So if we total, the percentage of the total material loss in the production process per initial input materials by weight was identified to *be approximately 38%* of the total losses generated from the starting process until the product shipped.

The summarizing of the material loss will show in the figure IV-3.

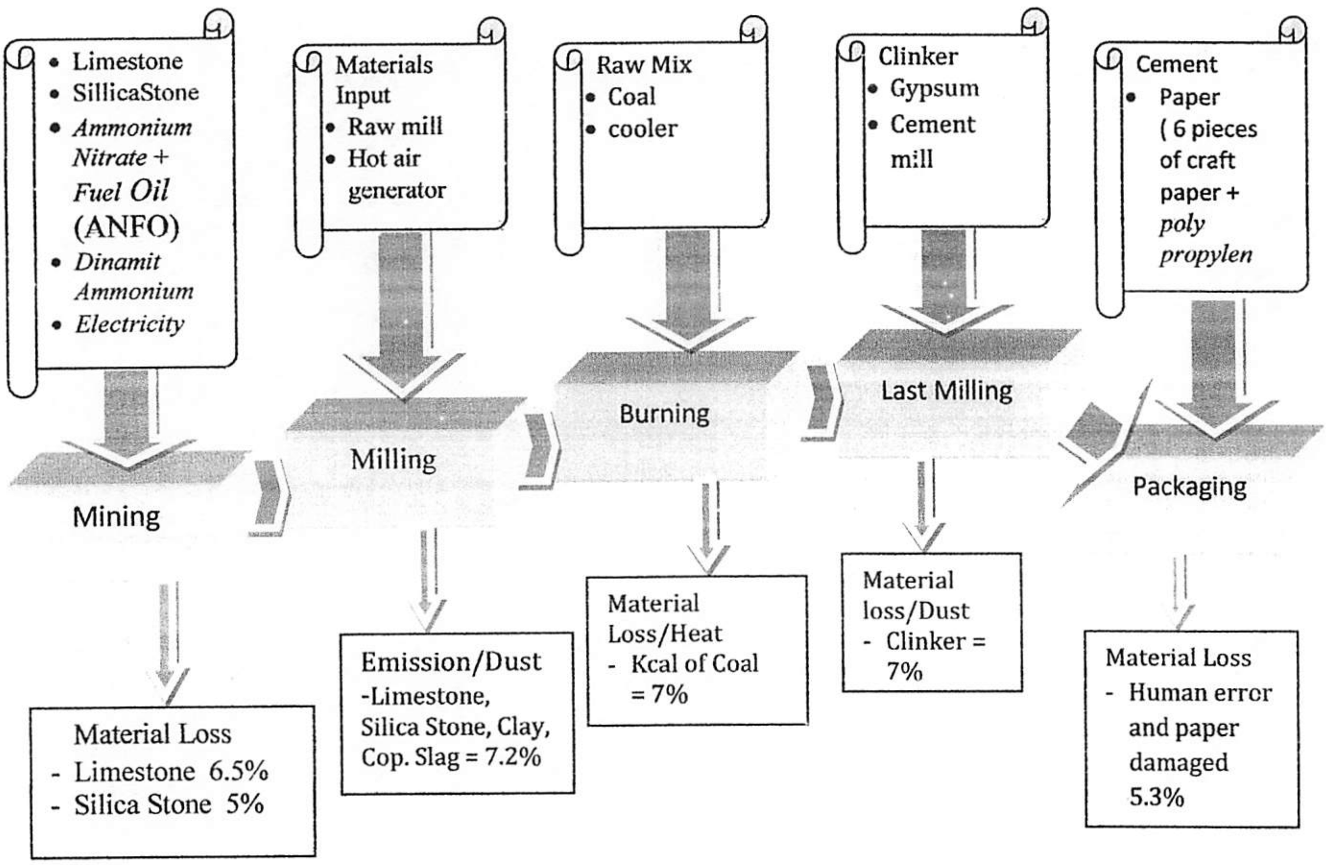


Figure IV-3: Material Loss Description Model

Also, there are the hidden of electricity power loss in each process is for approximately 5-7 % in each process in production and other department that need to be disclosed. So, the Management can improve the efficiency to reduce the cost.

As illustrated in Figure IV-3, the process consists of five processes that are Mining, Milling, Burning, Last Milling, and Packaging. PT Semen Padang has already adopted SAP database system to help the management in distributing the data as one of Management Information Control used. This system used as the operation controls and monthly closing. Material flow (e.g. input, output and yield rate) were managed through the main production/process unit through this system. Therefore, this system's control unit is help in quantifying the data collection in quantity centers for the purpose of MFCA.

Based on the Figure IV-3, there are the material losses before the material store to the warehouse. So, the amounts of the materials store the warehouse are not 100 % anymore from the first process of acquiring the raw material (88.5%). The calculation of the material losses its self will uses the percentage of 26.5 % (38% - 11.5% of losses in mining process). W The calculation of material loss its self can be display in Table IV-1 as follows;

Table IV-1

Material loss calculation for December 2010 Production

	unit	Main material				Auxiliary Material	Sub materials	Materials Total
		Limestone	Silica Stone	Clay	Copper Slag	pozzoland	Gypsum	
Input quantity (material purchased)*	ton	503.005	68.633	25.316	12.939	27.469	21.252	658.614
Positive product quantity (product shipped)**	ton	369.709	50.445	18.607	9.510	25.546	19.764	493.582
Negative pRoduct quantity (material loss)***	ton	133.296,33	18.187,75	6.708,74	3.428,84	1.922,83	1.487,64	165.032,12
Material purchasing unit price	Rp/ton	8.030	10.005,73	6.295,02	78.590,61	8.788,52	77.914,14	
Material purchasing cost****	Rp	4.039.130.150	686.723.267	159.364.726	1.016.883.903	241.411.856	1.655.831.303	7.799.345.205,36
Positive product cost (material cost)	Rp	2.968.760.660,25	504.741.601,31	117.133.073,85	747.396.701,10	224.513.025,97	1.539.923.112,05	6.102.468.174,53
Negative product cost (material cost)	Rp	1.070.369.489,75	181.981.665,78	42.231.652,47	269.474.234,24	16.898.829,91	115.908.191,23	1.696.864.063,38

Description:

* = presented base on data collection

** = Input Quantity - Negative Product Q

*** = calculation of loss (26.5%):

limestone = 0.265*503005

Silica stone = 0.265 * 68,633

clay = 0.265 * 25316

cop .slag = 0.265 * 12939

gypsum = 0.07 * 21,252

pozzolang = 0.07 * 27,469

**** = Material purchased x material purchased unit price

The calculation of material losses in the table IV-1 show from the total of material purchasing cost as Rp.7, 799,345,205.36, there are material losses (negative product) as Rp. 1,696,864,063.38. So, during the production process there is 21.75 % of cost from the total cost, that company spend as a waste or gas emission (non-product output). This is the point that the Company should consider again. The material losses amount must be the issue that Company should reduce by the next time period to gain more profitable through cost reduction. We can suggest to the company to upgrade the current technology used in production in order the performance of the machine in processing the raw material to become a product output properly optimize. Anyhow, maintaining the equipment periodically is one way to realize it.

After identifying the material loss in production process in PT Semen Padang, the next step is identifying the material input and output in the process that contribute to the environment.

IV.2.2.3. Identify the Material Inputs in Producing Cement

We can see that the material flow of Cement is divided into three main categories which are Input, Process and output. The output of the cement may be divided into two; Product Output and Non-Product Output or Failed Product. In Theoretical Framework as what have explained, the material Input contain of raw material and Auxiliary Materials, Packing Materials, Merchandise, Operating Materials, Water and Energy. As for specific and detail of materials flow of Cement, materials that are included as Inputs are;

Material	Scale
- Batu Kapur,	ton/ton Semen
- Batu Silika,	ton/ton Semen
- Tanah Merah,	ton/ton Semen

- Copper Slag,	ton/ton Semen
- Raw mix,	ton/ton Klinker
- Raw mix,	ton/ton Semen
- Klinker ,	ton/ton Semen
- Batu Bara,	ton/ton Klinker
- Batu Bara,	ton/ton Semen
- Gypsum,	ton/ton Semen
- Grinding Media	Gr/ton Semen
- Refractories	Kg/ton Klinker
- Refractories	Kg/ton Semen
- Heat Cons.	Kcl/Kg Klinker
- Heat Cons.	Kcl/Kg Semen
- Power Cons.	KWH/t.semen

Table IV-2. Material Input of making Cement

Each of those materials is processed continuously of the production with different level of treatment. But if we breakdown the material used, basically there are only *five* of basic raw material in cement making process. They are;

1. ***Batu Kapur***" limestone" as the primary material (81%) in cement making process is processed through exploding the in the "Bukit Karang Putih". Limestone is one of the sources of Oxide Calcium (CaO). This limestone are taken from the Bukit Karang Putih. The process of the mining of this limestone are;
   a. *Shipping* is removing or opening the shelf of the Bukit Karang's stone surface, so the layer of the limestone is achieved.
   b. *Drilling,* the process of the drill by using the crawler drill and drill master with air power push from the compressor. The hole drilling with 5.5 inch diameter is purposed to place the bomb.

c. *Blasting*, the process of exploding using dynamite and mixing material using Nitrate Ammonium and Fuel oil (ANFO)

d. *Dozing*, the process of collecting the pieces of limestone that exploded using dozer for the next step to be transported to the accommodated place.

e. Crushing, the process of resizing the material/limestone to the formatted size. This process is directly done in the mining are

Delivering the material to the silo of accommodating is used *belt conveyor.*

The usage of Limestone is considered to be a significant impact of the environmental impact on the residue it has produced after being processed. The residue will get special treatment which will be discussed in the next. The Exploding process has also created the denudation in that hill. So, the Bukit Karang putih its self nowadays has a very limited limestone that in projection less of 50 years mining. The main impact of the processing limestone is the existence of the dust in the air which polluted the air in such regency and place. Mostly, the limestone scars give mainly material of a pollution and dust in the air. Not only employee who work in the factory, but the people live around the factory suffer the dust of limestone every time.

2. ***Sillica Stone, "Batu silica"*** is the source of the Oxide Cilium (SiO2) and Oxide Aluminum (Al_2O_3). This material is explored in Ngalau Hill. The exploration are conducted not using dynamite but destroyed using *traxcavator* and carrying to the *crusher* using *wheel-loader or dump truck,* and the need is 9-10% of the raw material requirements.

3. **Clay** "Tanah Liat" is the source of Oxide Aluminum (AL_2O_3) and Iron Oxide (Fe_2O_3 and FeO). Clay is explored around the factory (Up Hill) and toke using *excavator* and transported with *dump truck* and the need is 9-10% of the raw material requirement.
4. **"Cooper Slag/Iron Sand"** Pasir Besi" has primary oxide in form Fe_2O_3 that the need only 1-2% from the total of raw material requirement. PT Semen Padang does not have the area of Iron Sand to be explored, so the way to fulfill the need of Iron Sand, PT Semen Padang acquired it from the Supplier.
5. **Gypsum** is the primary source of the $CaSO_4H_2O$. This material used as the restrain materials in order the cement not drying and freezing earlier. The need of Gypsum is delivered from Gresik, Australia and Thailand.

As mentioned before, the Packaging material also include in material cost of product input. The packaging of cement is a paper. As we know that packaging paper is used as a wrapper for Cement. The use of Paper will impact directly to the environment in terms of how many trees and wood are cut in the forest, how many O2 lose in the air, how big the risk of flood rise after the cut, abrasion, and the disappear of florae and fauna ecosystem.

All the machines used in the production of cement are included in the inputs. There are a many types and kind of machine in each factory, since in PT Semen Padang there are 5 factories; Indarung I- Indarung V. The machines also have a different function to treat a different raw material, which consume a different power and energy. In the operation process, most of the machines run by fuel or energy. Typically, these machines will produce heat and noise. So, what is the impact of this? Of course there will be a heat spread off to the air and the violation of the hearing.

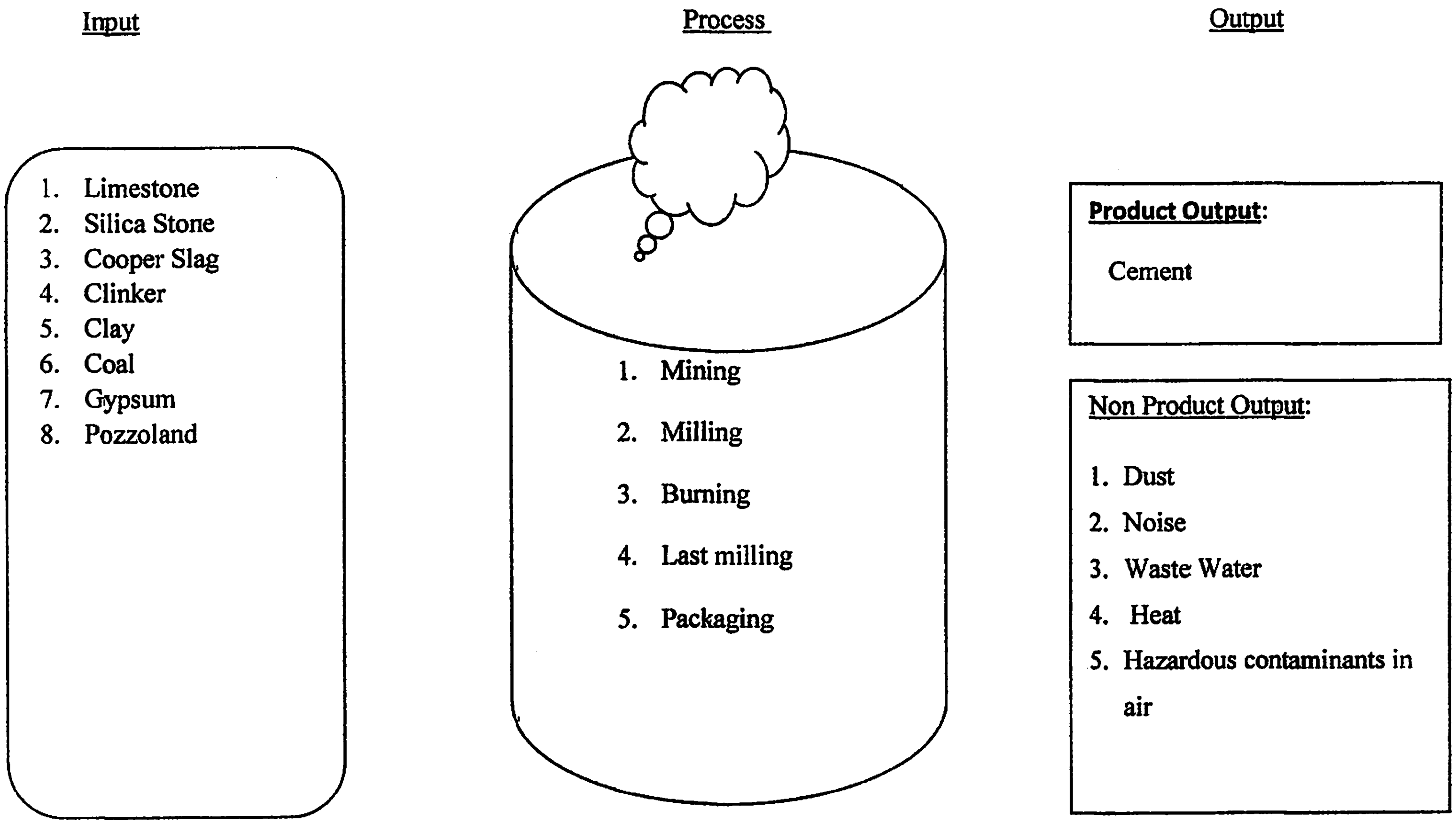
By all the running tools and machines, of course there is energy to run this. In PT Semen Padang, the energy used to operate the machines is Coal as the main and diesel fuel as the secondary energy, and of course electricity. All this kind of energy that the factory used will allocate to machine in produce a final product and also for running equipment such as computer, air conditioner and others. The machines that are run using coal and diesel fuel will create heat, noise and smoke from incinerations. However, heat, noise and smoke are kind of pollution that impact the environment no matter they are significant or not.

Water used by PT Semen Padang is coming from the soil water through exploration. The rest of water gets from Mineral Water Company. Even the production of cement not using water, but the residues of material that flow to the river have a significant impact to the society. This waste water has contaminated the field of 4 villages in Kelurahan Padang Besi, Koto Lalang that make the harvest of that field less 30-40% than it should be. The water is used mainly for the need of employee to support their work such as water in the office. However, the deep exploration of water in the long term will reduce the stock of water in the ground; so, it can decrease the surface of soil, the bad quality of water, and many impact for the social welfare.

Tracking all the inputs that are used in producing Cement is important to trace the kind of outputs and effort by the company does to solve the environmental impact that the input have created. It is also beneficial to determine the monetary side of Environmental Management Accounting to ensure that no inputs that unaccounted for.

The physical information which concludes as Material Flow of Cement can be seen in Figure IV-3 follows;

Figure IV-4.Material Flow Accounting of Cement



IV.2.2.4. Identify the Outputs that have Environmental Impacts and Company Effort to Control and Treat all forms of Non Product Outputs (NPOs)

In the previous Chapter, the output of the raw material processed may have two: Product Outputs and Non Product Output (NPO). From the Material Flow Analysis scheme we can see that the final Product Output is Cement Packaging, and the Non-Product Output. Between these outputs, Non-Product Output seems to have more impact on environmental. Hence, The Company ideally must give a big effort in reducing the environmental impact of the production process done. Now, we will discuss the Non Product Outputs from the production process and the program held by the management to control the Non Product Output resulted:

Raw Material:

1. Input: Limestone (80%-81%)

   Process: mining

   Non Product Output: Dust

   Effort by the company: Reclamation to the hill.

   For the dust resulted by the factory, in each Factory it's self there is a filter in the top of the funnel called *Electrostatic Precipitator (EP)* that has a function to minimize the amount of dust fly out to the air. So, the dust comes up to the air is already the very tiny size of the Limestone that can't be treated again.

2. Input: Silica Stone (10%)

   Process: Mining

   Non Product Output: Dust

   Effort by the company: Reclamation to the hill

For the dust resulted by the factory, in each Factory it's self there is a filter in the top of the funnel called *Electrostatic Precipitator (EP)* that has a function to minimize the amount of dust fly out to the air. So, the dust comes up to the air is already the very tiny size of the Sillica Stone that can't be treated again.

3. Input: Clay (8%)

   Process: Excavating and buy

   Non Product Output: none

4. Input: Dust Iron (2%)

   Process; Buy

   Non Product Output: none

5. Input : Gypsum (specified)

   Process: Buy

   Non Product Output: None

Packaging Material: paper

Process: Secondary Packaging

Non Product Output: Solid scrap waste of packaging material.

Effort: Any scrap or torn from packaging paper will be thrown away to the garbage and burned.

Energy

Input: Coal, diesel fuel

Process: Burning

Non Product Output: Heat and Noise

The Company has a grate cooler machine to stabilize the temperature and control heat produced, but for the noise carry out by the machine, the company does not have any device to control that.

Water

Process: to supply the employee need of working

Non-product output: Waste water

Effort: The Company just flow the water to the river and beach.

IV.2.3. Identify Monetary Information in developing EMA in PT Semen Padang

IV.2.3.1. Determine the Cost of Environmental Using EMA Approach

In MFCA approach, one of the most important goals for a company is to determine the environmental- related cost information that managers need to manage both their organization's environmental performance and its associated economic performance. As mentioned above, the cost of environmental-related can be easily traced after Inputs and Outputs have been determined. What we going to focus is to analyze the input by the cost component analysis in the Material Flow Cost Accounting in Semen Padang that contribute in Product Output and the Non Product Output. The Distribution of the material will be spread in the Environmental-related cost based on the Environmental-related activity in the year of 2010 in PT Semen Padang by using EMA approach;

IV.2.3.1.1 Material Cost of Product Outputs

This cost category includes the purchase costs of Material Inputs converted into product outputs. The cost is calculated for one year with estimation in PT Semen Padang.

1. *Cost of purchasing raw materials and Auxiliary Materials*

1.1.Cost for Using "limestone" on the December 2010

= 503,005 ton x Rp. 8.030.41/ Ton

= Rp. 4,039,336,382.05

Cost for one year; estimated the cost remains the same;

= Rp. 4,039,336,382.05 x 12

= Rp. 48,472,036,584.6

Actual cost of Limestone that contribute to material output;

= Rp. 48,472,036,584.6 – Rp. 10,179,127,682.8

= Rp. 38,292,908,901.8

1.2 Cost of using " Silica Stone" on the December 2010

= 68,633 ton x Rp.10,005.73/ ton

= Rp. 686,723,267.09

Cost for one year; estimated the cost remains the same;

= Rp. 686,723,267.09 x 12

= Rp. 8,240,679,205.08

Actual cost of Silica stone that contribute to material output;

= Rp. 8,240,679,205.08 – Rp.1, 730,542,633

= Rp. 6,510,136,572.01

1.3 Cost of using " Clay" on the December 2010

= 25,316 ton x Rp. 6,295.02

= Rp. 159,364,726.32

Cost for one year; estimated the cost remains the same;

= Rp. 159,364,726.32 x 12

= Rp. 1,912,376,715.84

Actual cost of Clay that contribute to material output;

= Rp. 1,912,376,715.84 – Rp. 401,599,110.3

= Rp. 1,510,777,605.51

1.4. Cost of using "Cop. Slag" on the December 2010

= 12,939 ton x Rp. 78,590.61

= Rp. 1,016,883,902.79

Cost for one year; estimated the cost remains the same;

= Rp. 1,016,883,902.79 x 12

= Rp. 12,202,606,833.48

Actual cost of Copper Slag that contribute to material output;

= Rp. 12,202,606,833.48 – Rp.2, 562,547,435

= Rp. 9,640,059,398.45

1.5 Cost of using " Gypsum" on the December 2010

= 21,252 ton x Rp 77,914.44/ ton

= Rp. 1,655,837,678.88

Cost for one year; estimated the cost remains the same;

= Rp. 1,655,837,678.88 x 12

= Rp. 19,870,052,146.56

Actual Cost of gypsum that contributes to the product per year is;

= Rp. 19,870,052,146.56 – Rp.4,172,710,951

= Rp. 15,697,341,195.78

Auxiliary material:

1.6 Cost of using " Pozzoland" on the December 2010

= 27,469 ton x Rp.8,788.52/ ton

= Rp. 241,411,855.88

Cost for one year; estimated the cost remains the same;

= Rp. 241,411,855.88 x 12

= Rp. 2,896,942,270.56

Actual cost of using pozzoland contributes to the product output as;

= Rp. 2,896,942,270.56 – Rp. 60, 835, 7876.8

= Rp. 2,288,584,393.74

2. Packaging Materials

The amount of Packaging Material used each month basicly is different. Because the fluctuations of order number. For average:

= 7,793,446 unit x Rp. 5,340

= Rp. 41,619,702

Cost for one year; estimated the cost remains the same;

= Rp. 41,619,702 x 12

= Rp. 499,436,424.00

Actual cost of using packing Material contributes to the product output as;

= Rp. 499,436,424.00 – Rp.24, 971,821.2

= Rp. 474,464,602.80

3. *Energy*

3.1. Cost of using " Coal" on the December 2010

= 65,774 ton x Rp.155,305.17/ ton

= Rp. 10,215,042,251.58

Cost for one year; estimated the cost remains the same;

= Rp. 10,215,042,251.58 x 12

= Rp. 122,580,507,018.96

Actual cost of using coal contributes to the product output as;

= Rp. 122,580,507,018.96 – Rp. 8,580,635,491.3272

= Rp. 113,999,871,527.6328

3.2. Cost of diesel fuel used by Indarung II/III, IV, and V

3.2.1. For Factory and Heavy Metal Tool

Cost for one year:

Factory	= 2,233,037 liter x RP. 4.500/liter	= Rp. 10,048,666,500
Heavy metal tool	= 422,527 liter x RP. 4500/liter	= Rp. 1,901,371,500
Total		= Rp. 11, 950,038,000

Actual cost of fuel that contributes to the product output as;

= 11, 950,038,000 – 836,502,660

= Rp. 11,113,535,340

3.3. Cost of Electricity used by Indarung II/III, IV, and V

Cost of electricity (MWH) used by Tambang, Indarung I, II, III, IV, V, Packing Plan, and Non Factory

Cost for one year

= 567,107 Mwh x Rp.166, 000

= Rp. 94,139,762,000

Actual cost of Electricity that contributes to the product output per year is:

= Rp. 94,139,762,000 – Rp. 6,589,783,340

= Rp. 87,549,978,660

IV.2.3.1.2 Material Cost of Non-Product Outputs

1. Raw and Auxiliary Material (loss 21%)

1.1. Limestone

= Rp. 48,472,036,584.6 x 21%

= Rp. 10,179,127,682.8

1.2. Silica Stone

= Rp. 8,240,679,205.08 x 21%

=Rp. 1, 730,542,633

1.3. Clay

=Rp. 1,912,376,715.84 x 21%

=Rp. 401,599,110.3

1.4. Cooper Slag

= Rp. 12,202,606,833.48 x 21%

= Rp.2, 562,547,435

1.5.Gypsum

= Rp.19, 870,052,146.56 x 21%

= Rp.4, 172,710,951

1.6.Pozzoland

= Rp. 2,896,942,270.56 x 21%

= Rp. 608,357,876.8

2. Packing Material

Packing Material is made from paper. There are some losses (5%) of packing material through packaging the product. The Total of Packing material contributes to the non product output is;

= Rp.499, 436,424.00 x 5%

= Rp.24, 971,821

3. Water

The cost of using water per year

= Rp. 11,316,699 x 12

= Rp.135, 800,388

4. Energy

4.1. Cost of Coal for total of factory in Indarung 1- Indarung 5 per one time production.

= 65,774 Ton xRp.155, 305.17

= Rp. 10,215,042,251.58

Cost for one year; estimated the cost remains the same;

= Rp. 10,215,042,251.58 x 12

= Rp. 122,580,507,018.96

For the energy/coal that contribute as non product output;

= Rp. 122,580,507,018.96 x 7%

= Rp. 8,580,635,491.3272

4.2. Cost of diesel fuel used by Indarung II/III, IV, and V

For Factory and Heavy Metal Tool

Cost for one year:

Factory	= 2,233,037 liter x RP. 4.500/liter	= Rp. 10,048,666,500
Heavy metal tool	= 422,527 liter x RP. 4500/liter	= Rp. 1,901,371,500
Total		= Rp. 11, 950,038,000

For the diesel fuel that goes out as gas emission is;

= Rp. 11, 950,038,000 x 7 %

= Rp. 836,502,660

4.3.Cost of electricity (MWH) used by Tambang, Indarung I, II,III,IV,V, Packing Plan, and Non Factory

Cost for one year

= 567,107 mwh x Rp.166, 000 = Rp. 94,139,762,000

The Total cost of Electricity that contribute as Non product Output is

= Rp. 94,139,762,000 x 7%

= Rp. 6,589,783,340

IV.2.3.1.3 Waste and Emissions Control Cost

This cost category covers cost of the effort that PT Semen Padang done to control and treat all forms of Non-Product Output once they have generated. This cost is calculated for one year. And this includes;

1. Equipment Depreciation = Rp. 795,379,185.25 (1 month)

    a. Cost to avoid heat

       Grate cooler:

       (1month) = Rp. 238,613,760.3

       (1 year) = **Rp.2, 863,365,123.6**

    b. Cost to filter the dust

       Electrostatic Precipitator (EP):

       (1month) = Rp. 556,765,424.95

       (1 year) = **Rp. 6,681,185,099.4**

2. Operating Material and Services

2.1. Cost for employee safety;

Helmet

=700 helmet x Rp. 90,000/unit

= Rp.63, 000,000

Shoes

= 700 shoes x Rp.300, 000

= Rp.210, 000,000

Uniform/clothes

=700 stem clothes x Rp. 150,000

=Rp.105, 000, 000

Mask

= 700 mask x 90,000

= Rp.63, 000,000

Air plug

=700 air plug x 20,000

= Rp.14, 000,000

2.2. Maintenance of Emission control equipment

1. *Maintain heat control equipment; Grate Cooler*

   = Rp. 1,449,620.4 (1 month)

   Cost for one year; assume the cost remain the same

   = Rp. 17,395,444.8

2. *Maintain dust control equipment: Electrostatic Precipitator (EP)*

   =Rp. 3,382,447.6 (1 month)

   Cost for one year; assume the cost remain the same

   =Rp. ***40,589,371.2***

3. Internal Personnel

   For the total of the employee who work in factory and directly responsible to the environmental Waste and Emission Control:

   = 1400 people x Rp. 3,000,000 (Average)

   = Rp. 4,200,000,000

4. Remediation and Compensation

   PT Semen Padang pay for the compensation of the not-maximum of farmer's field because of the contaminate water for Rp. 703,729,107. 00.

IV.2.4.Environmental Cost Reporting Method.

In presenting the environmental report, there are some items that should be classified to be environmental domain related cost categories. The way to classify it base on the direct involvement of environmental domain. The amount of the cost is trace based on the direct cost assigned. The author will explain the way to present the environmental report based on the cost classification of its involvement.

1. Material Cost for Product Output

   Material Cost for Product Output is the cost component that directly adheres to the product output or finished product.

   They are:

   a. Raw Material

      As what explained before, in cement making process, the material involved;

      1. Limestone,

         The amount of limestone consumption during year 2010 is Rp. 48,472,036,584.60 (503,005 ton x Rp. 8.030.41/ Ton x 12). As what identified, there are loss during production process as 21 %. The 21 % come from the accumulation of losses (air emission, dust, etc.) from Milling (7.2%), Burning (7%), and Last Milling (7%). So, from the total of Rp. 48,472,036,584.60 consumption, Rp. 10,179,127,682.8 (21% x Rp. 48,472,036,584.60) classify as negative product. From that, Rp. 38,292,908,901.8 (Rp. 48,472,036,584.60 – Rp. 10,179,127,682.8) classifies to be Product Output.

2. Silica stone

The amount of Silica Stone consumption during year 2010 is Rp. 8,240,679,205.08 (68,633 ton x Rp.10,005.73/ ton x 12). The total losses identified during the process is 21 % same with Limestone. From that percentage, known Rp.1, 730,542,633 (8,240,679,205.08 x 21%) identified as dust. So, Rp. 6,510,136,572.01 (Rp. 8,240,679,205.08 – Rp. 1, 730,542,633) moves to next step to be the product output.

3. Clay

Clay are process at the same time with Limestone and silica stone. It can be said that clay also has losses for 21 %. The total consumption of clay in year 2010 is Rp. 12,202,606,833.48 (25,316 ton x Rp. 6,295.02 x 12). It can be known the losses to be dust as Rp. 401,599,110.3 (Rp. 12,202,606,833.48 x 21%). So, the total of clay to be product output is Rp. 1,510,777,605.51 (Rp. 1,912,376,715.84 - Rp. 401,599,110.3)

4. Copper slag

Cooper Slag is one of the types of iron sand. PT Semen Padang buys this to acquire this. The total money spent to buy Cop slag is Rp. 12,202,606,833.48 (12,939 ton x Rp. 78,590.61x 12). The losses calculate 21 %. So, the separation cost of cop slag is; Rp.2, 562,547,435 (Rp. 12,202,606,833.48 x 21 %) as negative product, and Rp. 9,640,059,398.45 (Rp. 12,202,606,833.48 – Rp.2, 562,547,435) as positive product.

5. Gypsum

Is sub material to make the cement not freezing very quick .Total cost for gypsum is Rp. 19,870,052,146 (21,252 ton x Rp 77,914.44/ ton x 12). The calculation of losses is 21 %. So, the amount of Gypsum to be processed to be product output is Rp. 15,697,341,195.78 (Rp. 19,870,052,146.56 -Rp.4, 172,710,951), while the non product output calculated as Rp.4, 172,710,951 (Rp. 19,870,052,146.56 x 21%).

6. Pozzoland

This is the Auxiliary material. The used of pozzoland is occasionally.

From the calculation above, the total of Pozzoland acquire is 27,469 ton x Rp.8,788.52/ ton x 12 = Rp. 2,896,942,270.56. Amount of losses is 21 %. Thus, the total of negative material or dust is Rp. 2,896,942,270.56 x 21% = Rp. 60, 835, 7876.8, then the total of Pozzoland to be Positive Product is Rp. 2,896,942,270.56 - Rp. 60, 835, 7876.8 = Rp. 2,288,584,393.74

After calculating all the raw and auxiliary material cost, it can be select that the total cost that processed to be the product output or positive product amounted as Rp. 73,939,808,067.29. This total cost will post to the Raw and Auxiliary material cost in material cost of product output.

b. Energy

There are three kind of energy used in supplying the power in producing cement in PT Semen Padang.

1. Coal
2. Diesel fuel

3. Electricity

The amount of the energy cost that assigned to be material cost for product output is all that three kind of energy that used to process raw material. To classify the energy to be product output is calculate the total energy cost and deduct it with the amount of energy losses. Energy losses can identify within two methods; First, calculate the variance between the cost spend to acquire the energy (special for coal) with the difference between expected and actual of total of calorie. Second the energy losses calculate from the burning process in kiln machine.

So, from the analysis, the total of energy losses within a production process is 7%. First, the total of losses of coal is Rp. 8,580,635,491.3272 (Rp.122, 580,507,018.96 x 7 %). From that losses, the total coal contribute to the product output is Rp 122,580,507,018.96 – Rp. 8,580,635,491.3272= Rp. 113,999,871,527.6328. Second, the total of the diesel fuel consume during year 2010 is Rp. 11, 950,038,000. Then, the calculation of negative material is Rp. 11, 950,038,000 x 7% = Rp.836, 502,660. So the real actual of diesel fuel that contributes to process a raw material to be a product is 11, 950,038,000 – 836,502,660 = Rp. 11,113,535,340. Third, electricity is used in some machine to run its operation. The calculation of electricity loss is by heat produced. The total of electricity contribute to the non- product output is Rp. 94,139,762,000 x 7 % = Rp. 6,589,783,340. So, the actual cost of electricity contribute product output is Rp. 87,549,978,660 (Rp. 94,139,762,000 - Rp. 6,589,783,340).

The total of coal, diesel fuel and electricity cost that contribute to product then adding up. The amount of the total cost then used as the total energy cost in material cost for product output (Rp. 212,663,385,527.63).

c. Packaging Material

The cost of Packaging material calculate base on the total of paper used within a year then multiply with the cost of paper per unit. The cost per paper is calculated by the total cost of material to make a package a year then divided with the total of paper used in one year. So, it gets the cost of paper per unit is Rp. 5,340. Then from the information gathered the total paper used a year is 7,793,446 unit. So, the cost of packaging paper a year is Rp. 499,436,424.00. But during the process of packaging in packing plan department, the author got information that there is 5 % of packaging paper that damaged because of human error and machine error. From that, the author calculate the total of packaging paper cost used to be product output is Rp. 474,464,602.80 {Rp. 499,436,424.00 – (499,436,424.00 x 5%)}. So, Rp. 474,464,602.80 will be posted to the packaging material cost in environmental cost. Then, Rp.24, 971,821.2 will be posted as the packaging material for non product output cost.

d. Water

There is no water used in production process of making cement.

After identifying all the direct cost that used to making product, all of the total cost component in material cost for product output then sum up. So, the author got Rp. 287,077,658,197.72.

2. Material Cost for Non Product Output

Material Cost for Non Product Output is the cost that spends to be a negative product or waste and material used in supporting production process.

1. Raw Material

On the calculation of Material Cost for Product output, the author also included the amount of material losses. To calculate the amount of Material Cost for Non Product Output, it can be drag the cost of each material loss from that calculation.

a. Limestone, material loss is Rp. 10,179,127,682.8
b. Silica Stone, material loss is Rp. Rp.1, 730,542,633
c. Clay, material loss is Rp. 401,599,110.3
d. Copper Slag, material loss is Rp. Rp.2, 562,547,435
e. Gypsum, material loss is Rp.4, 172,710,951
f. Pozzoland, material loss is Rp. 60, 835, 7876.8

All of that material loss then summing up, the total of the material loss calculated as Rp. 19,654,885,688.90 used as material loss in environmental management accounting report.

2. Energy

The calculation of energy losses is based on the total of gas emission that smoked from the chimney and the heat resulted. It is the same with calculation of raw material, energy losses also had been calculated from the material cost for product output above.

1. Coal, total of coal smoked to be gas emission is Rp. 8,580,635,491.3272

2. Diesel fuel, total of diesel fuel smoked to be gas emission is Rp. Rp.836, 502,660

3. Electricity, total of electricity resulted to be waste heat is Rp. 6,589,783,340.

   The total of coal, diesel fuel, electricity losses is Rp. 16,006,921,491.33 will transfer as the energy loss in EMA report.

3. Packaging Material

   As what explained before, the packaging material that contributes to be non-product output is the packing material that damaged during the packaging process. The amount of packaging material losses is Rp.24, 971,821.2 that will posted in EMA report.

4. Operating Material

   The author can't identify the cost of operating material that contributes to be non product output.

5. Water

   Water used to support employee work, not classify as the raw material that process to make a product, since the production process is dry process.

   The cost for water that transfer as material cost for NPO is Rp. 135,800,388.00

3. Waste and Emission Cost Control

Waste and emission cost control is the cost spends to control the waste and emission. Based on IFAC guidance, there are some items that classify to control waste and emission.

a. Depreciation expense

The amount of depreciation here is the machine or equipment that used to control waste and emission only. There are two machine use in controlling waste and emission. First, Electrostatic Precipitator (EP) is to control the dust emission. Second, Grate Cooler is to control the heat produced from machine.

From the data gathered, it was identified that the total depreciation a month is Rp.795,379,185.25. So, the total of depreciation machine a year is Rp. 9,544,550,223.00. Based on the author identification, the number of EP is much more than grate cooler. It assumed depreciation for EP is 70%, and 30% of grate cooler of total depreciation of machine. Hence, the total depreciation of grate cooler a year is Rp.2,863,365,123.6 , while the depreciation cost for Electrostatic Precipitator a year is Rp. 6,681,185,099.4. So, this is the total of Rp. 9,544,550,223.00 in machine depreciation in EMA report comes from.

b. Operating material

Operating Material cost here is the operating material that used to control waste and emission. Based on the explanation above, some of operating material used are;

1. Helmet, total cost is Rp. 63,000,000
2. Shoes, total cost is Rp.210, 000,000
3. Clothes, total cost is Rp.105, 000, 000
4. Mask, total cost is Rp.63, 000, 000
5. Air plug, total cost is Rp.14, 000,000

The total of operating material is Rp.455, 000,000, will assigned as the total operating material posted in EMA report.

c. Internal Personnel

The cost in internal personnel is the cost of the employee that in chare in controlling waste and emission. Actually, the author can't trace the exactly number of employee that take a part in this job. But, base on the interviewed with the management, the number of employee who works in the factory is 1,400 people. They responsible to operate the machine, while in machine its self there are a tools to control emission.

The total of payroll cost for waste and emission cost control is Rp.4,200,000,000 will used as internal personnel cost in EMA report.

d. Remediation and Compensation

Is the amount of money that budgeted by PT Semen Padang to recovery the ecosystem or cleaning up the pollution. The total cost is relative the same each year that is Rp. 703,729,107. 00. This amount of cost will posted to EMA report.

Table IV-3. Distribution of Cost Category to Environmental Domains

ENVIRONMENTAL DOMAIN ENVIRONMENT-RELATED COST CATEGORIES	Air and Climate	Waste water	Waste	Soil, Ground Water	Noise and vibration	Biodiversity and Landscape	Radiation	Other	Total	Percentage
1. Materials costs Of Product outputs									287.077.658.197,72	**84,98%**
Raw and Auxiliary Materials									73.939.808.067,29	
Packaging Materials									474.464.602,80	
Energy									212.663.385.527,63	
Water									none	
2. Materials Costs Of Non-Product Outputs									35.822.579.389	**10,6%**
Raw and Auxiliary Materials									19.654.885.688,90	
Packaging Materials									24.971.821,00	
Operating Materials									Un-identified	
Water									135.800.388,00	
Energy									16.006.921.491,33	
3. WASTE And EMISSION CONTROL COSTS									14.903.279.330	**4,41%**
Equipment Depreciation.									9.544.550.223,00	
Operating Materials									455.000.000,00	
Water and Energy									Un-identified	
Internal Personel									4.200.000.000	
External Services									Un-identified	
Fees, Taxes and Permits									Un-identified	
Fines									Un-identified	
Insurance									Un-identified	
Remediation and Compensation									703.729.107,00	
4. Preventive And Other Environmental Management Cost	This cost category is not considered as part of EMA system development in PT Semen Padang									
Equipment Depreciation										
Operating Materials, Water, Energy										
Internal Personnel										
External Services										
Other										
5. RESEARCH and DEVELOPMENT COSTS	This cost category is not considered as part of EMA system development in PT Semen Padang									
6. LESS TANGIBLE COSTS	This cost category is not considered as part of EMA system development in PT Semen Padang									
Total									**337.803.516.916,95**	**100%**

... of Total Environmental-Related Activity Cost of PT Semen Padang in year 2010 in the amount of Rp 337.803.516.916,95

Based on the Table IV-3 above, it can be seen that the total Environmental-related activity cost is Rp. 337,803,516,916.95. So, from the entire total of Cost of Manufacturing Cost of Year 2010 for Rp. 3,101,907,201,848.00, 11 % of the total of manufacturing cost included as environmental cost.

In order to make it clear, the author will separate the cost component that contributes the higher cost during Production process.

1. Material Cost for Product Output

From that table IV=4, the component of environmental cost that contributes the biggest cost among others is Material Costs of Product Output (84.97%). The component that generates high cost is cost of energy (Coal, Electricity, and diesel fuel-74 %). From those three kinds of energy, there are two of them that contribute the highest cost. Firstly is Coal. Coal is one of the material input has created the biggest cost as well (54%) of energy sources, equal with Rp. 113,999,871,527.63/ year. it can be suggested to the company to reduce the cost usage of Coal. Since coal is the un-renewable energy which has a limited amount of stock nowadays. The use of Coal also gives a big impact to the Environment with emission. The company may think again to use other source of energy that eco-friendly to environment and renewable. As what researchers had developed, many alternatives that company can consider to be used to replace of coal, such as Biomass, Algae Fuel, Electric Vehicle, and Plug-in Hybrid Electric Vehicles (PHEV). These vehicles depend heavily on an effective charging infrastructure such as a smart grid infrastructure to be able to implement electricity as mainstream alternative energy for future transportations.

Secondly is Electricity. It contributes the higher cost after coal (41%) of cost of energy. The total used of Electricity is Rp.8, 754, 9978,660.00. PT Semen Padang acquires the source of electricity from State Electricity Company (PLN) and other resources such as PLTD Indarung, PLTA Kuranji, PLTA Rasak Bungo. The consumption of electricity in huge number may be as a driver to increase the level of global warming. So, the task of everyone generally and for the company specifically to think how to reduce the consumption of electricity and think how to substitute it with other resources to fill the need of electricity in running the business activity.

One alternative to minimize the used of electricity is by utilize the waste heat. The application is well known with Waste Heat Recovery Power Generation (WHRPG) developed by Japanese New Energy and Industrial Technology Development Organization (NEDO) in year 2009. With this technology, PT Semen Padang can reduce Green House (Carbon dioxide 46,000 ton) the result of suspension preheater and cooler of Indarung V and can build the electricity power with 8.5 MW. The total of saving by PT Semen Padang as Rp. 33 billion / year with assumption production time 7,440 hours/year and the cost is Rp. 540/KWH.

2. Material Cost for Non-Product Output

The second cost component that contributes higher cost is Material cost for non-product output that is Rp. 35,822,579,389 or 10.6 % of Total Cost Environmental Cost. In here, the component that contributes highest cost is cost of Raw and auxiliary Material, calculated as Rp. 19,654,885,688.9 or 55% of total material cost of Non product output (see p.86). During the production process, the raw material can't be proceeding effectively. As what explained in the previous sub-topic, 38 % of the total raw material are being loses during the production. The suggestion to the company is upgrade the current technology or train the existing employee can reduce the material losses because of the ancient machine instead human error.

The second component of higher cost is material cost for non- product output is energy cost (44%) or Rp.16, 006,921,491.33. The form of non product output is gas emission and heat. The composition of loss of energy is 54% for coal, 44% for electricity and 5% for diesel fuel. As what author has investigated, there are some of the non-value added that generated cost of Electricity. For instance, the used of equipment like air conditioner, light, computer, and other stuff that used under control. They are turned on all the time with used or unused condition. This condition make the cost of electricity still rising up while the use of electricity it's self is not sufficient to what it should be. Hence, the suggestion to the company is the management should control the use of electricity by checking them of the effective or not-effective used all the day. By doing so, the cost of electricity can be reduced.

3. Waste and Emission Control Cost

Based on the Table IV-IV, the consumption cost for waste and emission control is Rp.14, 943,868,701, or 4.42% of total Environmental cost. If it traced, the highest cost is Depreciation cost of dust filtering machine and grate cooler to control heat (64%) of the total waste and emission control cost (see p.88). If the company can use the machine that can produce less residue and dust, it also can reduce the cost related to activity to control those dust. By maintaining the machine regularly, the lifetime used of the machine can be extended.

Table IV-4

The Summary of Environmental Management Cost

No.	Cost Component of Environmental Domain	Total of Consumption	Impact to the Environmental	The potential Resources to be eliminated	The Potential effort to Control the Impact
	A. Material Cost For Product Output and Non Product Output.				
I	Raw Material	Rp.	Dust		
1.1.	Limestone	48,472,036,584.60	Mining the Limestone and Silica Stone will caused erosion of the Hill, destroy the ecosystem, and un balancing of the hill will caused land sliding.	The main material, Limestone should be thinking to substitute with other, but still produced good quality of product.	PT Semen Padang has done reclamation or res plant the plants.
1.2.	Silica Stone	8,240,679,205.08			
1.3.	Clay	1,912,376,715.84			
1.4	Cooper Slag	12,202,606,833.48			
1.5	Gypsum	19,870,052,146.56			
1.6	Pozzoland	2,896,942,270.56			
	Total	**73,939,808,067.29**			

No.	Cost Component of Environmental Domain	Total of Consumption	Impact to the Environmental	The potential Resources to be eliminated	The Potential effort to Control the Impact
II	Energy	RP.	Gas Emission and Heat		
II.1 II.2 II.3.	Coal Diesel Fuel Electricity Total	122,580,507,018.96 11,950,038,000 94,139,762,000.00 **228,670,307,018.96**	a. Mining the Coal will cause the running out of coal.PT Semen Padang uses the coal in burning process. High consumption will caused air emission to the environment and drive the global warming b. Fuel is non-renewable energy. High consumption will pollute the air. c. Electricity will drive a global warming and reducing ozone tissue.	All of the existing resources of energy are potential to be eliminated.	1. Coal can be substitute with Biomass 2. Diesel Fuel can be substitute with Biodiesel 3. Electricity can be substitute with Waste Heat or other renewable electricity power Generator.

CHAPTER V

CONCLUSSION

V.1. Conclusion

This research leads to the conclusion that the Environmental Management Accounting is the tool used by the management to evaluate the performance of environmental and economic performance through the development and implementation of appropriate environment-related accounting systems and practices. It is broadly defined to be identification, collection, analysis and using of the two types information for internal decision making that are physical information and monetary information. It is used as the complementary of the conventional accounting approach, with the aim to develop appropriate mechanisms that assist in the identification and allocation of environment-related costs.

The used of EMA and MFCA is appropriate to be developed and be applied in PT Semen Padang as it is one of the mining company which operations has always been giving direct impact to the environment and seek the material loss. However, PT Semen Padang has not implemented EMA and MFCA yet. While, it still uses conventional accounting system and approach towards its operations. Nevertheless, PT Semen Padang is already concern about the environmental impact and material loses creates from its production by doing some improvement and efforts to control and provide any requirement tools to treat or minimize any environmental impacts from the material inputs and outputs.

By developing EMA and MFCA in PT Semen Padang has result the determination of environmental-related activity cost in the amount of Rp. 337,803,516,916.95. In the current system, some costs are hidden in the factory overhead account. The amount is considered to be 11 % from the total of Manufacturing Cost (Rp. 3,101,907,201,848.00) . By the same time, PT Semen Padang also generated material loss for the total of Rp. 1,696,864,063.38 that hide from product cost. If the material cost is traced to be Rp. 7,799,345,205.36, so there is 21.75 % of the Total material cost classified as the material loss that the Company need to be aware and disclose it for the appropriate information for management decision making.

By preparing this report, management is able to know about information for the Environmental impact and material losses that give the opportunity reducing the cost and in the same time the Company will put effort of reducing waste and gas emission for saving the earth. When the Company is able to reduce its environmental-related cost and material loses during the production activity, it will be able to decrease overhead cost which will result in the efficiency of costing. By this strategy, the Company may gain competitive advantage in the market completion.

In designing the model of this Environmental Report, the author doesn't focus on the environmental costing but more focus on adopting IFAC guidance which talks about Environmental Management Accounting (EMA) and Material Flow Cost Accounting Guidance that focus on disclosing material losses. Therefore, this research is more likely presenting what has been guided in EMA made by IFAC and MFCA made by Japanese Ministry of Economy, Trade and Industry and developing it in PT Semen Padang.

V.2. Limitation of the Research

In calculating the environment-related activity cost, the author used some relevant estimation and the prior year data. Beside, the calculation of environment-related cost category doesn't cover all of the category, and for the calculation of the material loss, the calculation is calculated base on the data given by the Company and the percentage of loss is coming from interview with the management. There may be a possibility of differences between the real data in the company with the author calculation. This happen due to the limit information that can gather by the author related to confidential information and internality the company has.

In presenting Environmental report, The author also used only three cost categories of six cost categories of monetary information in EMA approach; material cost of product outputs, material cost of non product output and waste and emission control cost- during its operations. The Author just found these there cost categories, because PT Semen Padang hasn't implemented the other there categories yet. Even though the management already concerned about environmental operation, but they haven't done it in a deeper way.

As mentioned in the scope of research, this research doesn't distribute the environmental impact to environmental domain as shown in Table IV-4. Thus, this research can't present the whole information of EMA based on IFAC Guideline. Then, the presenting of Material Flow Accounting only focusing the material loss based on analyzing of data given. This is again due to limit information and ability in spinning each unit in PT Semen Padang.

V.3. Suggestion

Suggestions will be divided into two parts;

1. Suggestions for PT Semen Padang;

   1.1. PT Semen Padang must try to disclose the Material loss using MFCA Guide, in order the component of loss in total material loss can be trace and manage. The disclosing of material losses can help the company to reduce the activity that dangerous the environment and to initiate in saving the earth respectively.

   1.2.PT Semen Padang must do try to develop the environmental cost component that distributed to the physical and monetary aspect. There are several component of each monetary and physical Information of Environmental: Flow of Energy, Water, Material and Wastes that will affect the final output of information to be considered in making a decision by management. The company must develop this, make an analysis, make an assumption based on it, so the "material loss" in the production process could be minimize and give the optimum judgment of the cost used.

   1.3.PT Semen Padang should have initiate to perform specific environmental focus, such as green product, efficient production, packaging design, environmentally preferable purchasing raw material and environmental management system.

   1.4.Each Post that give a potential in material loss; not only loss in term to the gas emission but also the process post from the blasting of the limestone till the goods are shipped must develop using the high-technology in supporting efficiency and low defect product.

1.5.If the company is not yet ready to implement EMA (MFCA) system within a short term, it can tray to broaden development by doing more environmentally activities such as environmental planning system, environmental financial accounting.

2. Suggestions to overcome the research limitation:

2.1.Longer time horizons and scope analysis in order to analyze the condition before the material process give impact to the environment and provide the comparison analysis between the conventional accounting systems with EMA (MFCA) of the current situation.

2.2.A deeper interview with management who are involved and investigation to the object/location to reach a clear understanding the environmental cost component contribute to help us understand the reasons of every decision taken by the company and understand the history that brought the company to where it is now.

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Appendix

PT. SEMEN PADANG
DEPT. PRODUKSI II/III, IV, V

LAPORAN PRODUKSI KLINKER, SEMEN DAN RAW MIX
Bulan : Desember 2010

1 / QR / PTP10 / 04
Lampiran 1

RENCANA RKAP DAN REALISASI PRODUKSI, TON		BULAN												Jumlah	
		Jan	Feb	Mar	Apr	Mei	Jun	Jul	Agust	Sep	Okt	Nop	Des	%	Ton
A.KLINKER															
- Indarung II	,Rencana	59.740	53.560	37.080	57.680	57.680	57.680	59.740	59.740	57.680	59.740	40.040	59.720	100,00	660.080
	,Realisasi	55.185	32.202	65.577	59.305	65.551	41.609	61.281	50.040	49.107	64.551	58.427	50.700	99,01	653.535
- Indarung III	,Rencana	59.740	30.900	59.740	57.680	57.680	57.680	59.740	37.080	59.740	59.740	59.740	59.740	100,00	659.200
	,Realisasi	47.836	52.601	65.699	58.376	66.978	40.491	63.392	58.019	60.009	55.408	54.177	59.782	103,58	682.768
- Indarung IV	,Rencana	144.200	93.600	114.400	145.600	145.600	145.600	150.800	150.800	145.600	150.800	104.000	130.000	100,00	1.621.000
	,Realisasi	144.397	117.457	104.647	80.739	165.045	147.174	123.284	154.098	145.692	122.863	128.760	136.660	96,90	1.570.816
- Indarung V	,Rencana	82.000	213.200	237.800	229.600	237.800	237.800	237.800	237.800	98.400	139.400	229.600	237.800	100,00	2.419.000
	,Realisasi	53.075	213.398	214.422	207.098	206.472	237.867	166.653	207.453	219.899	175.036	199.034	115.129	91,59	2.215.536
- Jumlah	,Rencana	345.680	391.260	449.020	490.560	498.760	498.760	508.080	485.420	361.420	409.680	433.380	487.260	100,00	5.359.280
	,Realisasi	300.493	416.658	450.345	405.518	504.046	467.141	414.610	469.610	474.707	417.858	440.398	382.271		5.122.655
- %	,Realisasi	86,93	106,24	100,30	82,66	101,06	93,66	81,60	96,74	131,34	102,00	101,62	74,35	95,58	
- Total Stock Akhir		55.562	114.510	93.263	89.926	154.290	196.013	119.823	102.817	211.242	194.066	194.244	118.861		
B.SEMEN															
- Indarung I	,Rencana	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	,Realisasi	-	0	244	304	328	474	1.618	876	789	2.065	-	-	-	6.698
- Indarung II	,Rencana	61.600	44.000	63.800	63.800	66.000	63.800	63.800	63.800	61.600	61.600	61.600	61.600	100,00	737.000
	,Realisasi	55.510	43.276	39.885	59.943	68.430	57.303	63.812	69.022	32.489	58.141	46.634	57.545	88,47	651.990
	,Penj.klinker	-	-	7.358	-	-	-	13.650	6.144	-	-	-	-		27.152
- Indarung III	,Rencana	72.800	65.000	65.000	43.500	33.000	-	78.400	84.100	81.200	81.200	81.200	81.200	100,00	766.600
	,Realisasi	68.712	65.846	75.930	58.224	24.383	19.756	59.086	78.005	61.083	73.200	62.332	61.807	92,40	708.364
	,Penj.klinker	-	-	-	-	-	-	-	-	-	-	-	-		-
- Indarung IV.1	,Rencana	63.800	59.400	63.800	63.800	66.000	63.800	50.600	48.400	61.600	63.800	61.600	50.600	100,00	717.200
	,Realisasi	40.619	47.389	68.079	44.841	67.908	68.586	64.211	69.931	39.503	64.447	69.389	75.204	100,48	720.607
	,Penj.klinker	-	-	-	-	15.686	-	3.029	5.029	-	-	-	-		23.745
- Indarung IV.2	,Rencana	89.175	76.875	86.100	89.175	92.250	89.175	89.175	89.175	86.100	89.175	86.100	70.725	100,00	1.033.200
	,Realisasi	72.814	69.709	93.007	57.883	83.288	89.514	89.261	90.699	80.732	82.112	76.000	101.864	95,52	988.883
- Indarung V.1	,Rencana	86.000	103.200	120.400	124.700	128.050	124.700	124.700	124.700	120.400	120.400	120.400	124.700	100,00	1.422.350
	,Realisasi	72.314	68.763	116.129	118.166	115.337	117.608	131.769	110.652	104.518	105.629	117.726	84.104	88,78	1.262.715
	,Penj.klinker	-	-	201	-	-	-	6.226	-	-	-	-	-		6.427
- Indarung V.2	,Rencana	43.000	107.500	120.400	124.700	128.050	124.700	124.700	124.700	120.400	120.400	120.400	124.700	100,00	1.383.650
	,Realisasi	23.366	112.844	137.056	127.961	125.881	132.900	124.735	120.217	95.364	109.115	114.831	113.700	96,70	1.337.970
- Jumlah	,Rencana	416.375	455.975	519.500	509.675	513.350	486.175	531.375	534.875	531.300	536.575	531.300	513.525	100,00	6.060.000
	,Realisasi	333.335	408.327	530.330	467.322	485.555	486.141	534.492	539.402	414.478	494.709	486.912	494.224		5.676.227
- %	,Realisasi	80,06	89,55	102,08	91,69	94,59	104,28	100,59	100,85	78,01	92,20	91,65	96,24	93,65	
- Total Penjualan Klinker		-	-	7.559	-	15.686	-	22.905	11.173	-	-	-	-		57.324
- Stock Akhir	Padang :														
	OPC														
	Non OPC														
	Khusus														
	Luar Padang :														
	OPC														
	Non OPC														
- Total Stock Akhir		42.067	40.503	110.602	85.327	116.732	124.698	153.001	139.860	171.666	176.215	86.320	38.713		
C.RAW MIX															
- Indarung II	,Rencana	95.584	85.696	59.328	92.288	92.288	92.288	95.584	95.584	92.288	95.584	64.064	95.552	100,00	1.056.128
	,Realisasi	86.370	41.272	100.067	97.012	105.835	57.400	88.432	75.873	76.276	106.734	90.722	76.809	94,95	1.002.802
- Indarung III	,Rencana	95.584	49.440	95.584	92.288	92.288	92.288	95.584	59.328	95.584	95.584	95.584	95.584	100,00	1.054.720
	,Realisasi	77.314	87.028	100.390	92.049	106.404	64.608	103.342	102.357	85.472	86.180	83.818	92.484	102,53	1.081.446
- Indarung IV	,Rencana	230.720	149.760	183.040	232.960	232.960	232.960	241.280	241.280	232.960	241.280	166.400	208.000	100,00	2.593.600
	,Realisasi	225.426	192.151	157.498	122.370	263.989	234.638	193.486	237.327	231.488	196.145	201.866	216.324	95,34	2.472.708
- Indarung V	,Rencana	131.200	341.120	330.480	367.360	380.480	380.480	380.480	380.480	157.440	223.040	367.360	380.480	100,00	3.870.400
	,Realisasi	73.566	337.577	352.768	325.877	314.504	385.807	258.977	314.822	343.607	270.688	318.503	176.951	89,75	3.473.647
- Jumlah	,Rencana	553.088	626.016	718.432	784.896	798.016	798.016	812.928	776.672	578.272	655.488	693.408	779.616	100,00	8.574.848
	,Realisasi	462.676	658.028	710.723	637.308	790.732	742.451	644.237	730.379	736.843	659.747	694.909	562.568		8.030.601
- %	,Realisasi	83,65	105,11	98,93	81,20	99,09	93,04	79,25	94,04	127,42	100,65	100,22	72,16	93,65	
- Total Stock Akhir		37.875	47.782	40.254	48.110	53.746	65.457	59.605	53.590	50.582	57.422	64.247	51.108		

PT. SEMEN PADANG
DEPT. PRODUKSI II/III, IV, V

LAPORAN BAHAN DAN MATERIAL
Bulan : Desember 2010

1 / QR / PTP10 / 04
Lampiran 7

PABRIK	MATERIAL (TON) B.Kapur	BT/PS.Silika	T.Merah	Cop. slag	Raw Mix	Klinker	Bt.Bara	Gypsum	Semen	Pozzoland	BK type I	BK non OPC	Semen ke Tl.Bayur	Solar
A. Persediaan awal.														
- Indarung I						3.761								
- Indarung II	20.463	4.880			16.639	57.838			66.575					
- Indarung III														20.367
- Indarung IV	27.184	1.048			21.680	53.171								
- Indarung V	34.054	8.879			25.928	79.475								41.321
- Teluk Bayur									29.744					90.050
Jumlah	81.701	14.807			64.247	194.244			96.320					161.738
B. Penerimaan / Produksi										Pemakaian Pasir Silika				
- Indarung I									-					
- Indarung II	162.305	24.935			76.809	50.700			57.545	-				40.381
- Indarung III					92 484	59.782			61.807	-				
- Indarung IV 1	175.087	-			64.895	136.660			75.204	-	212.696			49.842
- Indarung IV 2					151.429				101.864	-				
- Indarung V.1	158.109	44.373			83.965	115.129			84.104	-				-
- Indarung V.2					92 986				113.700	-				
Jumlah	495.601	69.308			562.668	382.271			494.224	-				90.223
C. Pemakaian / Pengeluaran														
- Indarung I						-		-	1.192				-	
- Indarung II	66.977	9.371	3.456	1.767	79.599	50.526	9.299	2.474	59.237	4.775	-	-	230.433	31.594
- Indarung III	80.646	11.283	4.162	2.127	93.858	54.132	10.940	2.658		4.834	-	-		
- Indarung IV.1	59.275	7.917	2.920	1.493	214.556	65.931	24.762	3.234		3.654	749	1.937		31.047
- Indarung IV.2	135.713	18.474	6.814	3.483		89.189		4.380		5.036	975	2.691		
- Indarung V.1	75.792	10.244	3.778	1.931	180.753	74.383	20.775	3.616	-	3.867	901	1.673	-	47.600
- Indarung V.2	84.602	11.344	4.184	2.139		100.444		4.889		5.304	1.184	2.334		
- Teluk Bayur									272.856					
Jumlah	503.005	68.633	25.316	12.939	568.765	434.605	65.774	21.252	333.285	27.469	3.809	8.636	230.433	110.241
D. Persediaan akhir.														
- Indarung I		1.010				4.085								
- Indarung II	47.940	9.441			17.862	34.360			27.913					
- Indarung III														29.154
- Indarung IV	36.000	736			27.262	22.929								
- Indarung V	40.701	5.495			5.984	57.487								60.116
- Teluk Bayur									10.800					41.714
Jumlah	124.641,09	16.682			51.108	118.861			38.713					130.984
Sampai Dengan Bulan Ini :														
A. Penerimaan / Produksi										Pemakaian Pasir Silika				
- Indarung I									6.698					
- Indarung II	1.799.903	240.485			1.002.602	653.535			651.990	-				475.276
- Indarung III					1.081.446	682.768			708.364	1.001				
- Indarung IV.1	2.140.651	-			947.348	1.570.816			720.607	-				666.064
- Indarung IV.2					1.525.358				986.883	-				
- Indarung V.1	3.220.082	694.988			1.784.376	2.215.536			1.262.715	-				1.466.806
- Indarung V.2					1.689.271				1.337.970	-				
- Teluk Bayur														
Jumlah	7.160.836	935.473			8.030.601	5.122.658			5.675.227	1.001				2.608.146
B. Pemakaian / Pengeluaran														
- Indarung I						6.456		203						
- Indarung II	890.188	110.403	55.922	23.436	1.026.012	582.398	118.849	27.047		38.762	5.279	1.023		466.232
- Indarung III	944.824	116.499	60.035	24.680	1.072.051	832.346	124.214	29.118		44.341	3.827	969		
- Indarung IV 1	868.647	106.301	57.973	22.248	2.485.608	599.269	282.600	31.047		47.785	7.582	18.315		655.687
- Indarung IV 2	1.353.661	168.676	80.959	34.687		872.211		40.874		62.325	11.103	25.202		
- Indarung V.1	1.605.136	197.239	105.580	41.606	3.478.675	1.090.893	395.787	53.394		72.934	21.257	28.099		1.533.645
- Indarung V.2	1.528.011	187.152	99.988	39.367		1.153.407		56.402		76.592	21.154	34.468		
- Teluk Bayur														
Jumlah	7.190.467	888.271	480.458	186.003	8.042.545	4.936.980	921.450	238.084		342.739	70.201	108.076		2.655.564

Pengiriman Material, ton	Batu Kapur	Batu Silika	Tn. Merah	Cop. Slag	Raw Mix	Klinker	Batu Bara	Gypsum	Fine Coal	Pozzoland	Klinker Ke T.Byr
Dari Ind. I ke Ind. II/III						-					
Dari Ind. I ke Ind. IV						-					
Dari Ind. II / III ke Ind. I						-					
Dari Ind. II ke Ind. III								-			-
Dari Ind. III ke Ind. II											
Dari Ind. II ke Ind. IV				-	-	-	-	-	-	-	
Dari Ind. II ke Ind. V				-	-	26.028	-	-			
Dari Ind. IV ke Ind. I				-		-	-	-	-		-
Dari Ind. IV ke Ind. II/III					-						
Dari Ind. IV ke Ind. V				-	-	14.112	-	-			
Dari Ind. V ke Ind. I/II/III	-				2.470	-					-
Dari Ind. V ke Ind. IV	-	26.392			6.410	-					

Keterangan

- #) *Stock akhir Raw mix dikoreksi berdasarkan BA No.1115,1116,1117 / BA / BPP10 / 12.2010*
- #) *Stock akhir Klinker dikoreksi berdasarkan BA No.1118,1119,1120,1121 / BA / BPP10 / 12.2010*
- #) *Stock akhir Solar dikoreksi berdasarkan BA No.1122,1123,1124 / BA / BPP10 / 12.2010*
- #) *Stock akhir LS dan SS dikoreksi berdasarkan BA No.1125,1126,1127 / BA / BPP10 / 12.2010*
- #) *Stock akhir Semen PPI dikoreksi berdasarkan BA No. 103 / BAR / PGT11 / 12.2010*
- #) *Stock akhir Semen T.Byr dikoreksi berdasarkan BA No. 415 / BAR / PGT13 / 121.2010*

PT. SEMEN PADANG DEPT. PRODUKSI II/III, IV, V	LAPORAN SOLAR, KWH & POWER CONSUMPTION Bulan : Desember 2010	1 / QR / PTP10 / 04 Lampiran 8

URAIAN		Jan	Feb	Mar	Apr	Mei	Jun	Jul	Agust	Sep	Okt	Nop	Des	Jumlah	Keterangan
o Pemakaian Solar, Liter															
- Produksi II/III	Pabrik	14.497	64.208	58.218	27.961	16.485	50.099	1.901	36.927	24.591	14.838	19.098	21.622	350.444	Pem. Fly Ash :
	Alat Berat	8.902	8.844	8.587	8.164	9.457	11.775	11.064	10.112	9.068	10.951	8.892	9.972	115.788	Desember 2010
- Produksi IV	Pabrik	6.339	58.010	31.536	85.355	26.926	58.075	62.810	50.558	9.888	75.445	51.504	31.047	547.493	SZ1 (ton)
	Alat Berat	8.570	11.505	11.560	11.160	-	11.810	10.945	-	12.770	12.144	17.730	-	108.194	0
- Produksi V	Pabrik	190.378	91.205	150.220	109.698	90.092	56.739	167.643	115.910	88.790	131.600	95.225	47.600	1.335.100	SZ2 (ton)
	Alat Berat	12.075	17.285	19.805	18.685	18.285	25.555	20.630	15.035	18.015	16.650	16.525	-	198.545	0
- J u m l a h	Pabrik	211.214	213.423	239.974	223.014	133.503	164.913	232.354	203.395	123.269	221.883	165.827	100.269	2.233.037	S/D December
	Alat Berat	29.547	37.634	39.952	38.009	27.742	49.140	42.639	25.147	39.853	39.745	43.147	9.972	422.527	SZ1 (ton)
o Pemakaian Listrik, MWH															0
- Tambang		774	1.022	1.213	1.065	1.255	1.129	1.089	1.097	1.097	1.097	1.140	-	11.978	SZ2 (ton)
- Indarung I		-	-	12	14	16	23	77	41	37	98	-	-	318	0
- Indarung II		6.660	4.227	6.631	7.001	7.548	5.255	7.116	6.507	5.071	7.358	6.370	-	69.742	
- Indarung III		6.967	6.871	8.098	6.747	5.942	3.934	7.321	7.743	6.763	7.152	6.659	-	74.195	
- Indarung IV		15.025	13.007	14.231	9.623	16.730	16.135	14.772	16.606	14.819	14.074	14.438	-	159.660	
- Indarung V		8.576	20.725	23.757	22.531	21.450	23.773	20.419	21.433	21.347	19.121	21.570	-	224.701	
- Packing Plan		1.372	1.763	2.306	1.900	1.859	2.117	1.836	1.781	2.039	1.896	2.218	-	21.087	
- Non Pabrik		441	410	805	609	496	556	272	476	435	465	461	-	5.426	
J u m l a h		39.817	48.025	57.051	49.480	55.294	52.922	52.902	55.884	51.608	51.259	52.855	-	567.107	
C. CONSUMPTION FIGURE														Rata2	Standard
o TAMBANG													-		
Lime Stone	KWH/t.semen	2,01	1,94	1,85	1,94	1,94	1,96	1,93	1,93	1,84	2,11	1,99	-	1,78	1.80 - 2.00
Silica Stone	KWH/t.semen	0,22	0,20	0,20	0,19	0,20	0,22	0,24	0,31	0,23	0,26	0,28	-	0,21	0.20 - 0.40
o INDARUNG I															
Cement Mill	KWH/t.semen	#DIV/0!	-	47,50	47,50	47,50	47,50	47,50	47,10	47,52	47,52	#DIV/0!	#DIV/0!	#DIV/0!	
o INDARUNG II															
Raw Mill	KWH/t.raw mix	24,97	27,56	25,33	24,42	23,70	24,44	25,04	24,39	24,82	24,34	24,94	-	22,86	26,00
	KWH/t.semen	36,10	39,35	36,43	35,01	33,74	34,18	34,80	33,32	33,88	33,39	34,74	-	31,76	37,00
K i l n	KWH/t.Klinker	40,33	42,01	38,15	38,23	37,20	38,41	38,43	38,47	38,93	38,33	38,85	-	35,68	39,50
	KWH/t.semen	37,15	38,21	34,94	34,91	33,73	34,22	34,02	33,48	33,85	33,50	34,47	-	31,61	35,13
Cement Mill	KWH/t.semen	41,03	40,14	39,96	39,45	38,00	39,34	39,90	39,58	38,97	39,32	39,40	-	36,04	40,00
o INDARUNG III															
Raw Mill	KWH/t.raw mix	26,59	25,75	25,84	24,93	23,71	24,91	25,01	24,37	24,78	25,22	25,12	-	22,93	26,00
	KWH/t.semen	38,53	36,98	37,25	35,79	33,61	34,19	34,79	33,25	33,80	34,72	34,84	-	32,35	37,00
K i l n	KWH/t.Klinker	42,11	38,97	38,76	38,11	37,17	38,62	38,53	39,05	38,18	39,37	39,61	-	35,47	39,50
	KWH/t.semen	38,89	35,63	35,58	34,86	33,45	33,76	34,11	33,94	33,17	34,52	34,96	-	31,84	35,13
Cement Mill	KWH/t.semen	42,16	39,18	38,94	38,26	38,11	38,49	38,82	38,23	38,53	38,20	38,62	-	35,55	38,50
o INDARUNG IV															
Raw Mill IV.1	KWH/t.raw mix	24,44	24,72	26,46	24,32	23,69	24,91	25,10	24,64	24,40	24,58	24,88	-	23,03	26,00
	KWH/t.semen	34,12	33,74	34,83	31,69	31,41	33,50	33,93	34,45	33,63	33,15	34,66	-	30,09	35,67
Raw Mill IV.2	KWH/t.raw mix	18,90	17,84	21,72	17,78	16,46	16,65	17,54	17,40	17,44	17,43	17,57	-	15,91	16,50
	KWH/t.semen	25,61	23,63	28,59	23,16	21,82	22,38	23,71	24,33	24,05	23,51	24,48	-	21,67	22,84
K i l n	KWH/t.Klinker	38,44	37,21	39,96	38,90	36,03	37,27	39,24	38,36	38,33	37,95	38,36	-	34,76	38,50
	KWH/t.semen	33,26	31,39	33,50	32,27	30,42	31,92	33,78	34,16	33,66	32,60	34,04	-	29,44	33,01
Cement Mill IV.1	KWH/t.semen	39,64	39,32	39,33	38,55	38,03	38,22	39,19	38,12	38,73	38,67	38,81	-	34,69	39,50
Cement Mill IV.2	KWH/t.semen	41,42	39,06	38,22	38,69	37,29	38,03	38,62	38,07	37,96	#########	37,77	-	###########	38,50

PT. SEMEN PADANG
DEPT. PRODUKSI II/III, IV, V

CONSUMPTION FIGURES MATERIAL

Bulan : Desember 2010

1 / QR / PTP10 / 04
Lampiran 9

C. CONSUMPTION FIGURE		Jan	Feb	Mar	Apr	Mei	Jun	Jul	Agust	Sep	Okt	Nop	Des	Rata2	Standard
o INDARUNG V															
Raw Mill V.1	KWH/t.raw mix	21,87	17,02	17,83	17,18	16,16	15,14	17,69	16,42	16,80	16,73	16,83	-	16,11	16,00
	KWH/t.semen	30,01	22,37	23,53	23,06	22,03	20,46	23,71	22,07	22,90	23,02	23,59	-	21,60	21,70
Raw Mill V.2	KWH/t.raw mix	24,29	17,22	17,36	17,45	16,15	15,72	17,40	16,48	16,90	16,66	16,67	-	15,94	16,00
	KWH/t.semen	33,33	22,63	22,91	23,43	22,02	21,25	23,33	22,15	23,03	22,92	23,36	-	20,94	21,70
Kiln	KWH/t.Klinker	44,28	36,93	37,30	37,19	36,01	36,08	37,59	36,98	37,04	37,84	37,90	-	35,29	38,00
	KWH/t.semen	38,48	30,91	31,35	31,79	31,27	31,06	32,09	31,67	32,16	33,15	33,83	-	29,74	32,20
Cement Mill V.1	KWH/t.semen	47,66	39,39	38,01	37,46	37,04	36,77	37,45	37,19	37,08	37,13	37,45	-	35,52	37,75
Cement Mill V.2	KWH/t.semen	47,95	38,62	37,56	37,27	37,01	36,98	37,46	37,17	37,09	37,15	37,31	-	34,37	37,75
o PACKING PLANT	KWH/t.semen	4,12	4,32	4,35	4,06	3,83	4,35	3,44	3,30	4,92	3,83	4,56	-	3,72	3,80 - 4,00
Rata2 Raw mill	KWH/t.raw mix	23,17	20,04	21,31	20,10	19,23	18,30	20,67	19,58	19,60	19,89	19,62	-	18,61	19,70
Rata2 Kiln	KWH/t.Klinker	40,40	37,66	38,25	37,82	36,33	36,88	38,35	37,85	37,78	38,15	38,37	-	35,20	38,52
Rata2 Cmt mill	KWH/t.semen	#DIV/0!	39,16	38,38	38,02	37,41	37,65	38,33	37,93	37,79	########	#DIV/0!	#DIV/0!	#DIV/0!	38,45
o Rata2 PC. Pabrik	KWH/t.semen	#DIV/0!	98,61	100,34	98,31	95,34	94,32	99,67	97,68	97,53	########	#DIV/0!	#DIV/0!	#DIV/0!	100,40
o Indarung I															
- Klinker ,	ton/ton Semen	#DIV/0!	-	0,960	0,964	0,964	0,964	0,964	0,964	0,964	0,964	#DIV/0!	#DIV/0!	#DIV/0!	
- Gypsum,	ton/ton Semen	#DIV/0!	-	0,040	0,040	0,040	0,040	-	0,040	0,040	0,040	#DIV/0!	#DIV/0!	#DIV/0!	
- Grinding Media	Gr/ton Semen	#DIV/0!	-	-	-	-	-	-	-	-	-	#DIV/0!	#DIV/0!	#DIV/0!	
- Power Cons.	KWH/t.semen	#DIV/0!	-	47,50	47,50	47,50	47,50	47,50	47,10	47,52	47,52	#DIV/0!	#DIV/0!	#DIV/0!	
o Indarung II															
- Batu Kapur,	ton/ton Semen	1,310	1,243	1,254	1,259	1,270	1,401	1,213	1,202	1,208	1,211	1,219	1,202	1,250	1,287
- Batu Silika,	ton/ton Semen	0,153	0,144	0,146	0,118	0,142	0,166	0,163	0,160	0,160	0,167	0,170	0,168	0,155	0,150
- Tanah Merah,	ton/ton Semen	0,058	0,121	0,101	0,107	0,114	0,096	0,069	0,062	0,055	0,055	0,056	0,062	0,080	0,048
- Copper Slag,	ton/ton Semen	0,029	0,031	0,035	0,036	0,036	0,036	0,032	0,031	0,031	0,032	0,032	0,032	0,033	0,028
- Raw mix,	ton/ton Klinker	1,569	1,570	1,570	1,570	1,570	1,570	1,670	1,570	1,570	1,570	1,570	1,570	1,570	1,600
- Raw mix,	ton/ton Semen	1,446	1,428	1,438	1,434	1,424	1,399	1,390	1,366	1,385	1,372	1,393	1,378	1,402	1,423
- Klinker ,	ton/ton Semen	0,921	0,910	0,916	0,913	0,907	0,891	0,885	0,870	0,870	0,874	0,887	0,876	0,893	0,889
- Batu Bara,	ton/ton Klinker	0,182	0,183	0,182	0,183	0,173	0,183	0,182	0,183	0,183	0,183	0,183	0,183	0,182	0,182
- Batu Bara,	ton/ton Semen	0,168	0,166	0,167	0,167	0,157	0,163	0,161	0,160	0,159	0,160	0,162	0,161	0,162	0,162
- Gypsum,	ton/ton Semen	0,038	0,040	0,040	0,042	0,043	0,043	0,041	0,040	0,040	0,043	0,043	0,043	0,041	0,035
- Grinding Media	Gr/ton Semen	342	1.050	-	-	108	505	-	-	266	-	-	-	168	143
- Refractories	Kg/ton Klinker	-	-	7,699	0,135	-	1,288	-	0,040	8,713	-	0,034	-	1,528	1,194
- Refractories	Kg/ton Semen	-	-	7,052	0,123	-	1,147	-	0,035	7,576	-	0,030	-	1,365	1,062
- Heat Cons.	Kcl/Kg Klinker	845	845	837	833	789	840	834	840	843	839	841	846	835	830
- Heat Cons.	Kcl/Kg Semen	778	768	766	761	715	749	738	731	733	734	747	743	746	738
- Power Cons.	KWH/t.semen	114,28	117,70	111,32	109,37	105,48	107,74	108,73	106,38	106,70	106,20	108,61	-	99,41	110,39
o Indarung III															
- Batu Kapur,	ton/ton Semen	1,313	1,253	1,258	1,262	1,266	1,079	1,215	1,200	1,207	1,214	1,213	1,199	1,230	1,230
- Batu Silika,	ton/ton Semen	0,153	0,145	0,147	0,118	0,141	0,129	0,162	0,160	0,160	0,188	0,169	0,168	0,154	0,145
- Tanah Merah,	ton/ton Semen	0,057	0,122	0,101	0,107	0,113	0,073	0,067	0,062	0,055	0,055	0,051	0,062	0,075	0,047
- Copper Slag,	ton/ton Semen	0,029	0,032	0,035	0,036	0,035	0,028	0,031	0,031	0,031	0,032	0,030	0,032	0,032	0,027
- Raw mix,	ton/ton Klinker	1,569	1,570	1,570	1,570	1,570	1,570	1,571	1,570	1,570	1,570	1,571	1,570	1,570	1,600
- Raw mix,	ton/ton Semen	1,449	1,436	1,441	1,436	1,413	1,372	1,391	1,364	1,364	1,377	1,387	1,375	1,402	1,423
- Klinker ,	ton/ton Semen	0,924	0,915	0,918	0,915	0,900	0,874	0,885	0,869	0,889	0,877	0,883	0,876	0,893	0,889
- Batu Bara,	ton/ton Klinker	0,183	0,183	0,182	0,183	0,174	0,183	0,182	0	0,183	0,183	0,183	0,183	0,186	0,182
- Batu Bara,	ton/ton Semen	0,169	0,167	0,167	0,167	0,157	0,160	0,161	0	0,159	0,160	0,162	0,160	0,145	0,162
- Gypsum,	ton/ton Semen	0,038	0,040	0,040	0,041	0,043	0,043	0,041	0,040	0,040	0,043	0,043	0,043	0,041	0,035
- Grinding Media	Gr/ton Semen	-	-	138	62	209	2,583	-	186	252	262	-	-	168	139
- Refractories	Kg/ton Klinker	1,658	-	-	-	-	0,049	-	0,207	8,487	-	0,478	-	0,921	1,089
- Refractories	Kg/ton Semen	1,532	-	-	-	-	0,043	-	0,130	7,373	-	0,422	-	0,822	0,969
- Heat Cons.	Kcl/Kg Klinker	846	840	838	838	788	845	834	0	840	841	842	841	764	830
- Heat Cons.	Kcl/Kg Semen	782	768	769	767	709	739	738	0	730	737	743	736	682	738
- Power Cons.	KWH/t.semen	119,59	111,80	111,77	108,91	105,06	106,44	107,72	105,42	105,50	107,44	108,42	-	99,84	110,39

PT. SEMEN PADANG DEPT. PRODUKSI II/III, IV, V	CONSUMPTION FIGURES MATERIAL Bulan : Desember 2010	1 / QR / PTP10 / 04 Lampiran 10

MATERIAL		Jan	Feb	Mar	Apr	Mei	Jun	Jul	Agust	Sep	Okt	Nop	Des	Rata2	Standard
o Indarung IV															
- Batu Kapur,	ton/ton Semen	1,207	1,164	1,141	1,113	1,164	1,189	1,188	1,245	1,237	1,192	1,234	1,207	1,192	1,351
- Batu Silika,	ton/ton Semen	0,143	0,134	0,134	0,134	0,133	0,142	0,154	0,164	0,161	0,165	0,170	0,168	0,151	0,157
- Tanah Merah,	ton/ton Semen	0,055	0,119	0,099	0,102	0,106	0,083	0,069	0,063	0,055	0,054	0,056	0,062	0,076	0,051
- Copper Slag,	ton/ton Semen	0,027	0,029	0,032	0,033	0,033	0,031	0,031	0,032	0,032	0,031	0,032	0,032	0,031	0,029
- Raw mix,	ton/ton Klinker	1,566	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,600
- Raw mix,	ton/ton Semen	1,355	1,324	1,316	1,303	1,326	1,345	1,352	1,398	1,379	1,349	1,393	1,375	1,353	1,372
- Klinker ,	ton/ton Semen	0,865	0,843	0,838	0,830	0,844	0,856	0,861	0,891	0,878	0,859	0,888	0,876	0,862	0,857
- Batu Bara,	ton/ton Klinker	0,181	0,180	0,181	0,181	0,172	0,180	0,180	0,181	0,181	0,181	0,181	0,181	0,180	0,179
- Batu Bara,	ton/ton Semen	0,156	0,152	0,152	0,150	0,145	0,154	0,155	0,162	0,159	0,156	0,161	0,159	0,155	0,153
- Gypsum,	ton/ton Semen	0,039	0,040	0,040	0,041	0,044	0,043	0,043	0,043	0,043	0,043	0,043	0,043	0,042	0,035
- Grinding Media	Gr/ton Semen	-	209	-	176	-	-	-	120	221	-	34	-	55	115
- Refractories	Kg/ton Klinker	-	-	-	8,928	-	-	-	0,078	0,161	-	1,456	-	0,601	1,062
- Refractories	Kg/ton Semen	-	-	-	7,408	-	-	-	0,069	0,141	-	1,282	-	0,518	0,911
- Heat Cons.	Kcl/Kg Klinker	806	804	805	805	760	803	807	807	808	807	806	804	801	790
- Heat Cons.	Kcl/Kg Semen	698	678	675	668	641	688	695	719	709	693	715	704	690	677
- Power Cons.	KWH/t.semen	102,70	98,29	103,41	97,78	94,17	97,24	100,63	100,99	99,07	########	101,65	-	###########	104,36
o Indarung V															
- Batu Kapur,	ton/ton Semen	1,196	1,205	1,181	1,176	1,203	1,205	1,196	1,206	1,223	1,224	1,241	1,232	1,207	1,265
- Batu Silika,	ton/ton Semen	0,143	0,133	0,134	0,138	0,136	0,143	0,157	0,157	0,159	0,168	0,171	0,169	0,151	0,146
- Tanah Merah,	ton/ton Semen	0,059	0,118	0,099	0,100	0,109	0,083	0,067	0,060	0,055	0,055	0,056	0,062	0,078	0,047
- Copper Slag,	ton/ton Semen	0,028	0,029	0,032	0,033	0,034	0,031	0,031	0,031	0,031	0,032	0,032	0,032	0,032	0,027
- Raw mix,	ton/ton Klinker	1,579	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,600
- Raw mix,	ton/ton Semen	1,372	1,314	1,320	1,342	1,363	1,352	1,340	1,344	1,363	1,375	1,402	1,388	1,355	1,356
- Klinker ,	ton/ton Semen	0,869	0,837	0,841	0,855	0,868	0,861	0,854	0,856	0,868	0,876	0,893	0,884	0,863	0,847
- Batu Bara,	ton/ton Klinker	0,181	0,179	0,178	0,179	0,170	0,179	0,179	0,180	0,180	0,180	0,180	0,180	0,179	0,177
- Batu Bara,	ton/ton Semen	0,157	0,150	0,150	0,153	0,147	0,154	0,153	0,154	0,156	0,158	0,161	0,159	0,154	0,150
- Gypsum,	ton/ton Semen	0,039	0,041	0,040	0,042	0,043	0,042	0,043	0,043	0,043	0,043	0,043	0,043	0,042	0,035
- Grinding Media	Gr/ton Semen	-	55	-	-	-	-	-	-	-	-	-	-	4	109
- Refractories	Kg/ton Klinker	16,393	-	1,770	-	0,011	0,101	-	0,188	1,077	-	0,890	-	0,780	0,695
- Refractories	Kg/ton Semen	14,247	-	1,488	-	0,010	0,087	-	0,161	0,935	-	0,794	-	0,673	0,589
- Heat Cons.	Kcl/Kg Klinker	812	790	787	791	746	792	802	802	803	802	801	803	792	775
- Heat Cons.	Kcl/Kg Semen	705	662	662	676	648	682	685	687	697	703	715	709	684	657
- Power Cons.	KWH/t.semen	117,03	92,35	92,31	92,40	90,32	88,82	93,07	90,96	92,21	93,26	94,69	-	85,93	92,58
Rata-Rata PT Semen Padang															
- Batu Kapur,	ton/ton Semen	1,256	1,210	1,190	1,195	1,212	1,226	1,204	1,225	1,229	1,213	1,238	1,219	1,217	1,287
- Batu Silika,	ton/ton Semen	0,147	0,136	0,137	0,132	0,136	0,145	0,157	0,160	0,160	0,166	0,170	0,168	0,152	0,150
- Tanah Merah,	ton/ton Semen	0,057	0,119	0,099	0,102	0,109	0,084	0,068	0,062	0,055	0,054	0,055	0,062	0,077	0,048
- Copper Slag,	ton/ton Semen	0,028	0,030	0,032	0,034	0,034	0,031	0,031	0,031	0,031	0,031	0,032	0,032	0,032	0,028
- Raw mix,	ton/ton Klinker	1,569	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,570	1,600
- Raw mix,	ton/ton Semen	1,390	1,340	1,353	1,362	1,365	1,355	1,359	1,367	1,368	1,367	1,396	1,380	1,366	1,377
- Klinker ,	ton/ton Semen	#DIV/0!	0,859	0,857	0,864	0,868	0,864	0,863	0,870	0,871	0,871	#DIV/0!	#DIV/0!	#DIV/0!	0,861
- Batu Bara,	ton/ton Klinker	0,181	0,180	0,180	0,181	0,172	0,180	0,181	0,181	0,181	0,181	0,181	0,182	0,180	0,179
- Batu Bara,	ton/ton Semen	0,161	0,155	0,154	0,156	0,149	0,155	0,156	0,135	0,158	0,158	0,161	0,159	0,154	0,154
- Gypsum,	ton/ton Semen	#DIV/0!	0,040	0,040	0,041	0,043	0,043	0,042	0,042	0,042	0,043	#DIV/0!	#DIV/0!	#DIV/0!	0,035
- Grinding Media	Gr/ton Semen	#DIV/0!	348	39	148	62	197	-	144	162	58	#DIV/0!	#DIV/0!	#DIV/0!	119
- Refractories	Kg/ton Klinker	3,159	-	1,984	1,797	0,005	0,170	-	0,138	2,523	-	0,891	-	0,839	0,9
- Refractories	Kg/ton Semen	#DIV/0!	-	1,682	1,563	0,004	0,147	-	0,120	2,186	-	#DIV/0!	#DIV/0!	#DIV/0!	0,810
- Heat Cons,	Kcl/Kg Klinker	821	805	806	807	762	805	813	709	813	815	813	815	797	793,1
- Heat Cons,	Kcl/Kg Semen	#DIV/0!	691	690	697	661	695	702	617	709	710	#DIV/0!	#DIV/0!	#DIV/0!	683
- Power Cons Pabrik	Kwh/t.sem	#DIV/0!	98,51	100,34	98,31	95,34	94,32	99,67	97,68	97,53	########	#DIV/0!	#DIV/0!	#DIV/0!	100,40
- Power Cons. PT.SP	Kwh/t.sem	#DIV/0!	106,33	109,49	105,96	102,77	102,14	105,65	103,90	106,15	########	#DIV/0!	#DIV/0!	#DIV/0!	105.00 - 110.00

PT. SEMEN PADANG DEPT. PRODUKSI II/III, IV, V	PENGIRIMAN , PENGELUARAN SEMEN & PRODUKSI MASING MASING TYPE Bulan : Desember 2010	1 / QR / PTP10 / 04 Lampiran 13

Pengiriman Semen ke Tik. Bayur		Jan	Feb	Mar	Apr	Mei	Jun	Jul	Agust	Sep	Okt	Nop	Des	Jumlah
o Dari Indarung I	,KKSP	-												-
o Dari Indarung II/III/IV														
- Curah	Type I	97.764	87.010	106.178	118.211	123.641	122.480	140.784	144.870	113.177	107.019	156.570	95.336	1.413.041
- Curah	PPC	-	-	-	-	-	-	-	-	-	-	-	-	-
o Dari Indarung V														
- Curah	Type I	-	-	-	-	-	-	-	-	-	-	-	-	-
- Curah	PPC/PCC	-	-	-	-	-	-	-	-	-	-	-	-	-
o Jumlah		97.764	87.010	106.178	118.211	123.641	122.480	140.784	144.870	113.177	107.019	156.570	95.336	1.413.041
Pengeluaran Semen														
o Dari Indarung I		-	-	116	-	240	325	40	410	-	1.281	769	384	3.566
o Dari Indarung II (PPI)		110.994	96.431	98.257	67.752	41.256	38.713	36.976	31.012	21.769	35.735	227.630	37.090	843.614
o Scal Indarung I		-	-	-	109	-	-	46	-	341	-	-	808	1.304
o Scal Indarung II/III/IV		12.391	13.512	13.896	13.615	11.719	13.764	17.524	17.150	7.783	16.852	20.407		158.612
o Scal Indarung V		-	-	-	-	-	-	-	-	-	-	-	-	-
o Teluk Bayur	,Kantong	53.438	84.039	112.008	111.037	84.068	89.499	103.788	86.987	92.437	88.209	67.809	82.523	1.055.843
	,Curah	131.814	139.165	141.808	200.130	166.476	198.945	181.894	252.074	144.573	167.225	238.329	190.333	2.152.766
o Jumlah		308.638	333.147	366.085	392.642	303.760	341.244	340.269	387.633	266.903	309.303	554.943	311.138	4.215.704
Produksi Klinker dan Semen Masing - masing type, ton														
o.Klinker Ind. II	, type I	55.185	32.202	65.577	59.305	65.551	41.609	61.281	50.040	49.107	64.551	58.427	50.700	653.535
	, OWC	-	-	-	-	-	-	-	-	-	-	-	-	-
- T o t a l		55.185	32.202	65.577	59.305	65.551	41.609	61.281	50.040	49.107	64.551	58.427	50.700	653.535
o.Klinker Ind. III	, type I	47.836	52.601	65.699	58.376	66.978	40.491	60.545	58.019	60.009	55.408	52.061	59.782	677.805
	, OWC	-	-	-	-	-	-	2.847	-	-	-	2.116	-	4.963
- T o t a l		47.836	52.601	65.699	58.376	66.978	40.491	63.392	58.019	60.009	55.408	54.177	59.782	682.768
o.Semen Ind.I	, type I	-	-	-	-	-	-	-	-	-	-	-	-	-
	, type II	-	0	-	548	328	474	1.618	876	789	2.065	-	-	6.698
	, type V	-	-	-	-	-	-	-	-	-	-	-	-	-
	, OWC	-	-	244	(244)	-	-	-	-	-	-	-	-	-
	, SMC	-	-	-	-	-	-	-	-	-	-	-	-	-
- T o t a l		-	0	244	304	328	474	1.618	876	789	2.065	-	-	6.698
o.Semen Ind. II	, type I	54.303	38.148	34.942	48.881	52.175	28.575	21.831	11.121	3.166	10.113	13.815	4.454	321.524
	, SMC	-	1.620	-	-	-	-	-	-	-	-	-	-	1.620
	, PPC	1.207	3.503	4.943	11.062	16.255	28.728	41.981	57.901	29.323	48.028	32.819	53.091	328.846
- T o t a l		55.510	43.276	39.885	59.943	68.430	57.303	63.812	69.022	32.489	58.141	46.634	57.545	651.990
o.Semen Ind. III	, type I	68.712	61.102	67.360	48.519	15.853	4.338	19.148	11.211	5.106	16.446	13.294	2.164	333.253
	, SMC	-	1.702	-	-	-	-	-	-	-	-	-	-	1.702
	, PPC	-	3.042	8.570	9.705	8.530	15.418	39.938	66.794	55.977	56.754	49.038	59.643	373.409
- T o t a l		68.712	65.846	75.930	58.224	24.383	19.756	59.086	78.005	61.083	73.200	62.332	61.807	708.364
o.Semen Ind. IV.1	, type I	22.760	14.177	15.243	4.739	10.093	20.089	13.133	43.407	23.093	22.218	40.729	29.969	259.650
	, SMC	-	1.712	-	-	-	-	-	-	-	-	-	-	1.712
	, PPC / PCC	17.859	32.000	52.836	40.102	57.815	48.497	51.078	26.524	16.410	42.229	28.660	45.235	459.245
- T o t a l		40.619	47.889	68.079	44.841	67.908	68.586	64.211	69.931	39.503	64.447	69.389	75.204	720.607
o.Semen Ind. IV.2	, type I	35.632	22.846	20.679	3.892	10.044	26.544	23.393	57.003	45.309	31.185	44.217	39.008	359.752
	, SMC	-	1.388	-	-	-	-	-	-	-	-	-	-	1.388
	, PPC / PCC	37.182	45.475	72.328	53.991	73.244	62.970	65.868	33.696	35.423	50.927	31.783	62.856	625.743
- T o t a l		72.814	69.709	93.007	57.883	83.288	89.514	89.261	90.699	80.732	82.112	76.000	101.864	986.883
o.Semen Ind. V.1	, type I	59.485	24.194	38.301	59.960	64.632	56.934	60.954	58.373	49.459	54.562	69.439	45.043	641.336
	, PCC	12.829	44.569	77.828	58.206	50.705	60.674	70.815	52.279	55.059	51.067	48.287	39.061	621.379
	, PPC	-	-	-	-	-	-	-	-	-	-	-	-	-
- T o t a l		72.314	68.763	116.129	118.166	115.337	117.608	131.769	110.652	104.518	105.629	117.726	84.104	1.262.715
o.Semen Ind. V.2	, type I	10.426	38.084	45.340	68.475	72.800	63.595	52.495	58.418	51.298	61.275	63.837	59.206	645.249
	, PCC	12.940	74.760	91.716	59.486	53.081	69.305	72.240	61.799	44.066	47.840	50.994	54.494	692.721
	, PPC	-	-	-	-	-	-	-	-	-	-	-	-	-
- T o t a l		23.366	112.844	137.056	127.961	125.881	132.900	124.735	120.217	95.364	109.115	114.831	113.700	1.337.970
- T o t a l	, type I	251.318	196.551	221.865	234.466	225.597	200.076	190.954	239.533	177.431	195.799	245.331	179.844	2.560.764
	, type 42.5 R	-	-	-	-	-	-	-	-	-	-	-	-	-
	, type 32.5 R	-	-	-	-	-	-	-	-	-	-	-	-	-
	, SMC	-	6.422	-	-	-	-	-	-	-	-	-	-	6.422
	, PPC	82.017	203.354	308.221	232.552	259.630	285.592	341.920	298.993	236.258	296.845	241.581	314.380	3.101.343
	, type Khusus	-	0	244	304	328	474	1.618	876	789	2.065	-	-	6.698
- Total Semen		333.335	406.327	530.330	467.322	485.555	486.141	534.492	539.402	414.478	494.709	486.912	494.224	5.675.227

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Rajin Pangkal Pandai, Malas Pangkal Bodoh!

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Writer