

Environmental Management System and Green Productivity (EMS_GP) Implementation in Kurdistan Cement Plant

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Abstract: *the cement plant has many environmental aspect that can lead to pollution. For managing this effects we must use of environmental and productivity technique to minimize this effects. In this study, the Kurdistan cement plant as a case study had studied by use of two important technique: green productivity and environmental management systems as ISO. For there more, this plant environmental aspect had identified by brainstorming and specialist opinion. Then those causes are specified and for each one proposed an option for controlling it. Finally in order to applying this options, these are prioritized by ranking them. The spraying water on dust from mining and transportation is first option to applying.*

Keywords—*green productivity, environmental management system, cement plant, environmental aspect*

I. Introduction

In the context of debate on the considerable human and material damage generated by environmental degradation, the role of the environmental performance of companies merits attention [1]. To identify the main factors able to influence the maturity of the environmental management practiced by each organisation [2]. The maturity of the environmental management of companies concerns the environmental level or stage of evolution in the environmental management of the companies [3]. This environmental maturity (EMM) may be influenced by many factors, not only technical (e.g., ‘cleaner’ technologies) but also organisational and human, related to the motivation and training of employees to achieve the goals of environmental management, leading companies to better environmental maturity [4, 5, 6]. Among the organisational and human factors relevant to environmental management, environmental training (ET) stands out as one of the most relevant ones [7, 5, 8]. And paradoxically as one that has received less attention from experts [9].

Green Productivity and Environmental Management Systems are complementary systems and both help improve the environmental performance of an organization. GP is an analytical methodology to help identify opportunities to prevent pollution and improve productivity, especially resource productivity. GP uses a number of different analytical tools, but it does not require development of a specific management structure or documentation. The process specifies how an organization can review its operations to look for waste and poor resource productivity, but is not a comprehensive set of policies or procedures for an organization[10].

An EMS in contrast, is a management system designed to help identify environmental impacts and implement improvements. An EMS consists of policies and procedures to help minimise a company’s impacts on the environment on a routine basis. An EMS does dictate how to improve performance, but provides an internal system to manage environmental performance and to ensure continual improvement. Successful implementation of an EMS will require the use of analytical methodologies such as GP, but EMS itself is not an analytical tool. Rather it is a process for ensuring a company takes action to continually improve its environmental performance.

The GP assessment methodology works within the framework of an EMS to help a company concentrate on opportunities to prevent pollution and improve material productivity. The process of developing and running a GP program for several ‘cycles’ is an excellent foundation for developing a broader EMS. To move from GP to EMS appropriate documentation needs to be developed and the GP assessment practices needs to be integrated into the company’s daily operations (eg. add audit procedures to operation manuals, adjust job descriptions). In addition, the scope of environmental assessment activities may need to be broadened. Although the GP methodology can be used in any part of a company, many organizations use it primarily for manufacturing areas. A complete EMS however requires a company to address all the potential environmental impacts in all departments. This would include office areas, transportation, storage and even product distribution.

II. Material and methods:

2.1 Case study

Kurdistan Cement Company, the largest industrial unit roof of Iranian Kurdistan province in the northwest city of Bijar. The production capacity of 3,200 tons of clinker per day to continue its activities.

Geographical location and general specifications of factory

- the factories km northwest 5 Bijar
- Plant capacity: 3,200 tons of clinker per day
- Altitude: 2017 meters
- The average minimum and maximum temperature maximum and minimum -24°C $+37^{\circ}\text{C}$
- Wind speed and direction dominant: 32 meters per second
- The annual rainfall: 619 mm
- potential severity of the earthquake: 98 Mercalli

2.2 Methods

The methodology of the project broadly followed the GP methodology introduced by the Asian Productivity Organization (APO) and the ISO 14001 standard requirements to establish an Environmental Management System. The GP methodology was used as a foundation for implementing ISO 14001 in KurdistanCement Company. In this way the methodology diverges from the traditional GP methodology. Each step of methodology has been further divided in to a number of tasks as follow:

Step 1: Getting Started

Task 1: GP – EMS team formation

GP methodology is based on a participatory approach, where by environmental management and solutions are carried out by a team of employees. It is necessary, when initiating a GP process that management sponsors and facilitates team formation in the relevant departments, and that roles within these teams are assigned and resources are provided to undertake their responsibilities. These roles should focus on the skills and experiences of the employees, in relation to their role within the enterprise. A broad range of members that are involved in the widest verity of processes and tasks is optimum. The teams should encourage all levels of employees to input into the process. A steering committee is also necessary to oversee the program, which should have representation from both internal and external personnel. External personal may include members of organisations who are providing technical advice as well as from other effected parties, for instance the local community.

Task 2: Walk through survey of the production process

A preliminary audit of the business should be undertaken, that compiles basic information about the resources available and the processes involved. It will include such information as personnel, machinery, equipment and processes. It will also briefly detail possible sources of environmental problem or areas of inefficient use of resources. It should include a flow diagram of the processes involved as well as all inputs and outputs, including waste and products.

Step 2: Planning

Task 3: Training on GP methodology and ISO 14000 standard.

The objective of the training workshop was to train the senior management of the cement factory on GP methodology and Environmental Management System. The following topics were covered in the training:

- GP methodology tools and techniques
- Environmental Management System according to ISO 14001 standard (awareness and documentation).
- Identification of problems and causes/environmental legal and other requirements, Aspect and impacts.
- Generation, evaluation and prioritisation of GP options;

Task 4: Identification of Problems and Causes

Building on the preliminary audit an in depth discussion of the areas that require improvement is undertaken. Identifying and recording specific problems is carried out using analysis techniques including brainstorming to locate and then pinpoint the cause of problems existing in the system.

Task 5: Setting Objectives and Targets

After identifying the problems and their causes, it is necessary to set objectives and targets to ameliorate them.

- Objectives should be based on problems and causes identified.
- One objective can have multiple targets.
- Targets should be based on 'needs'.
- Indicators should be established to track the progress of each objective.

It is necessary to prioritise the problems, with relation to their feasibility, costs and the resources and technologies that are available.

Step 3: Generation, Evaluation and Prioritisation of GP Options

Task 6: Generation of GP Options

The most significant task in GP methodology relates to the development of GP options. These options emerge directly from the cause analysis. The use of techniques such as brainstorming and group discussions improve the quality of ideas. A logical approach to generating options is as follows:

- Establishing a brainstorming exercise for generating options, based on the identification of causative factors,
- Determine the nature of the solution required.

Task 7: Screening, Evaluation and Prioritisation of GP options

Not all GP options generated need a detailed evaluation. Some of the GP options can be eliminated on the basis of certain criteria, or by the process of screening. GP implementation at community level has many different features in comparison with other sectors, especially in technical skill and funding fields. That is why these options need to be carefully evaluated; otherwise the success of GP options may be negligible. The option evaluation needs to directly relate to feasibility. This includes technology, economic viability (rate of turnover from investment, payback period), environmental aspects and social aspects.

After assessing the option based on this criteria the options may be divided into 3 categories:

Options to be applied. These options are usually inexpensive, efficient and easy to implement and maintain.

Options needing further analysis. These options usually require a significant financial investment and/or the expected outcomes are not clear.

Options which are not suitable. These options are usually very expensive and complicated. Often technical expertise that is not present within the organisation would be required, even after project implementation for maintenance.

Step 4: Implementation of GP Options

Task 8: Formulation of GP plan

The development of a document that considers important logistical aspects of GP implementation is required. Some topics in the GP plan will include finances, resources, technology and timeframe. The implementation plan should also contain a detailed activity plan, input, required time frame and the persons responsible for implementation. It may combine the work of various GP teams in different sections.

A plan will be most effectively implemented if all members involved in the implementation are interested and aware of all the factors involved. The GP team needs to answer the following questions when designing the plan.

- What needs to be done?
- What is the timetable for implementation?
- Who will be responsible for each task?
- How will each option be implemented?
- How/Where will equipment and expertise be sourced?
- What support is available (are there others have implemented in a similar industry, or is other external technical advice available)?

Task 9: Implementation of selected Options

The GP team together with experts and the support of the management strata implement all steps detailed in the implementation plan. Training needs should be identified and provided where required.

Task 10: Training, awareness building and developing competence

The provision of training may cover a broad range of topics. It will be required for the GP – EMS teams in the methodology and environmental management strategies EMS internal audit, but also for those on site using equipment and procedures that may be altered in the GP process. The degree of training required will vary between GP options and may also take a variety of forms from formal seminars to informal on the spot instruction. Some options will require no training, implementation can be immediately and others may require a significant training period. Options will therefore be implemented at various stages. Some options may be interdependent.

Step 5: Monitoring and Review

Task 11: Monitoring and Evaluation of Results

The monitoring and evaluation of GP options is an important task in the project cycle. It enables a comparison to be made between the objectives and the outcomes of the project. Project coordinators from the VPC have a responsibility to review the project, and external experts are also invited to evaluate these results. Any problems identified within the project need to be assessed and possible solutions identified. Monitoring should be an ongoing task of a GP program, it should occur at all stages of implementation, ensuring that problems are identified and solved as soon as possible. The aim of GP projects is to achieve sustainability, which is only possible if problems are identified and if possible solved quickly.

Task 12: Management review

Management reviews are necessary to evaluate the progress of the GP project. All activities must be recorded during the implementation of project for future reference. After implementation, management together with the steering committee must examine the GP program to determine how effective the project has been at meeting the specified objectives. When reviewing, management will look at the final report and other ongoing documentation from the project.

Step 6: Sustaining GP

Task 13: Incorporating changes into the organization's system of management

GP cannot exist in isolation. It needs to be integrated with regular activities of the management and day-to-day functioning of the enterprise. Therefore, all employees need to be familiar with the activities and objectives of the GP program. Participation of the workforce as well as consultation with other interested parties, including the community in which the industry is based is an important factor contributing to the long-term sustainability of GP. One way to ensure that GP becomes a regular activity is to document and enforce procedures within each work area.

Task 14: Identifying new/ additional problem areas for continual improvement

Once the first cycle of GP is complete within the organisation, the procedures and knowledge should be in place so that the cycle may be repeated. Green Productivity system specifically designed to facilitate continuous improvement.

Tools

2.4.1 Management Tools

GP tools provide information on the equipment and devices utilized in implementing GP plans. One of the most essential elements in GP tools is brainstorming, a process in which ideas are generated from answering critical questions such as: "What are solutions to reduce dust generation? What is the best choice?" The more people involved in the brainstorming process, the greater the amount of quality ideas will be available. The best choice will be selected from a number of solutions. The process flow was a useful tool to see in the detail of each activity to find out where the waste generated and understand whole the production process. This tool can identified exactly where have problem.

Equally important to brainstorming is the fish bone diagram, also known as a cause-and-effect diagram. It displays all the possible reasons and causes that contribute to a specific result. This diagram is used in the solving most problems, particularly in large-scale problems that have resulted from a number of causes and are related to a number of activities. Therefore, the fish bone diagram plays a crucial role in pinpointing problems in order to solve them.

A matrix is often set up to rate the feasibility of a number of options. Not all options are selected for implementation, due to the difference in priorities. Those options, which are significant and applicable, will have the first and foremost priorities. Similarly, the less difficult and low-cost options also have advantages over the more difficult and high-cost ones. In fact, it is not so easy to classify the priorities of options because the most urgent ones often requires high costs for implementation while the inexpensive ones are not so applicable.

2.4.2 Environment Tools

As one of the two components making up GP tools, environmental tools, often called technical tools require a number of specific skills such as good housekeeping, solid waste management, wastewater treatment, air pollution treatment, mass balance and process flow.

Good housekeeping aims to minimize wastes, prevent the loss of material water pollution and money for a company. This tool requires the involvement of all individuals together, forming a cohesive company. If each member of the company takes responsibility for using the right way of oil, material transportation as well as rag oil, the pollution by company contributed to environment will consequently be reduced.

GP tools also focus on oil contamination in wastewater, dust generation and solid waste management. Solid waste are often collected and separated to hazard waste, recyclable and non-recyclable waste before delivery for treatment.

III. Result and discussion

3.1 GP implementation

GP implementation in Kurdistan Cement Company was based on the GP methodology that introduced by APO and integrated with ISO 14001 development process.

- Getting started

GP-EMS Team formation

Establishing a GP team is an effective method for considering all possible aspects the existing problems in a company. A team should effectively utilise the skills and experiences of many people and incorporates their various ideas, views and opinions. GP-EMS team was established in Kurdistan Cement Company. These teams

consisted of top-level management and managers from all involved departments such as the technical, quality control and environmental management department, as well as the labour union.

Problem identification

Based on the data collected from survey the GP-EMS team conducted a group discussion to list all problems in each process related to environment and productivity. See Table 1.

Table.1. Problems of Kurdistan cement company

Depart ment/ Process	Problems	
	Environmental	Productivity
Mining and transportation of raw material	-Dust from mining explosions, transportation and loading and unloading of raw materials	
Limestone crusher process	- Noise pollution - Dust generation	-Short lifetime of hammer -Low capacity
Clay crusher process	- Noise pollution - Dust generation	
Conveyer belt transportation from crusher to storage	- Dust generation at direction change points (from this conveyer to other conveyer)	
Kilns	- Waste heat - Air emissions - Wastewater - Waste oil - Oil leakage - Solid waste	- Low inefficiency of kiln - Energy consumption
Compressor room	- Noise - Oil leakage	
Cement mill		- Production lower than design capability - Energy consumption
Loading clinker and cement	- Dust generation	
Packaging area	- Dust generation - Solid waste	
Maintenance workshop	- Wastewater - Solid waste - Air emissions	
All company	- Solid waste	

Cause identification

This task very important so that the GP-EMS team used GP tools such as brainstorming to find out the root causes of each problem.

Table.2. Problems of Kurdistan cement company

Depart ment/ Process	Problems	Causes	Options
Mining and transportation of raw material	- Dust from mining explosions, transportation and loading and unloading raw materials	Material too dry A lot of dust on the road	Spray water on the limestone before upload and unload
Limestone crushing process. Clay crushing process	- Noise pollution	Old crushers	Wearing ear Protection equipment
	- Dust emissions	- Bag filter operate inefficiency and bag damaged	- Periodical maintenance of bag filter and should be change damaged bags filter diligently.
	Short lifetime of the limestone crusher's hammer Low capacity	- See fish bone diagram	- Reduce SiO2 in limestone by change mixer formula - Install a pre-crusher and screen.
Conveyer belt transportation from crusher to storage of line I	- Dust generation at direction change points (from this conveyer to other conveyer)	- The bag filter efficient and has low capacity - Not cover all conveyor belt at that point	- Replace by new bag filter - Cover the point lack off.

Raw material mill	- Capacity lower than design capacity	Material output coarse	-decrease size of material out put
Kilns	- Low inefficiency of kiln	-high energy consumption of pre heater	- Install auxiliary furnace for preheater
	- Waste heat	- Lack of waste heat recovery system	- Install a waste heat recovery generation system in both kilns.
Compressor room	- Noise	- Old compressor - Lack of noise prevention facility	- Install noise protection box to cover individual compressors - Build a separate operation room
	- Oil leakage	- Old compressors	- Increase maintenance activities - Replace to new compressors
Cement mill	- Lower capacity		- Install a pre-grinding system upstream of the existing ball mill.
Clinker Loading	- Dust generated when loading the clinker onto the ship.	- Existing dust collector's capacity (80 m ³ /min) is too small. - Dust suction pipe too small - The cover of suction head is not inadequate	- Replace filter with Electrostatic precipitator (EP) - Change the cover with one that has improved material and design
Packaging area and cement loading	- Dust generation during packaging, transporting on conveyor belt, loading cement on ship truck on train		- Modify the dust collection system at packaging machine - Education class for employees
All company	- Solid waste generation from all departments	- Lack of solid waste management regulation. - Solid waste collection system inadequate. - Lack of awareness on environment protection. - Lack of environmental management system.	- Applying Hard Regulation - Install a new waste collector system - Training for employees related to waste oil generation

In order to prioritization the option for decreasing and management of environmental and productivity, with the remaining 16 options, GP – EMS team screened, evaluated to set priorities for each options. Some criteria that were chosen to evaluate them are:

1. Cost of investment: the higher cost of investment, the lower the priority of option
2. The complexity of technique: the more complicated, the lower priority of option
3. The efficiency of option both in terms of environmental performance and productivity: the more efficiency, the higher priority of option
4. The ability of workers to control and operate system: the easier for worker to operate, the higher priority of option
5. Suggested options were ranged from 1-5 marks for each criteria, in which 1 represents for the low and 5 presents for higher priority. All options are listed and evaluated by criteria as the table below:

Table.3. priority of option

	Criteria 1	Criteria 2	Criteria 2	Criteria 4	multiple	priority
Spray water on the limestone before upload and unload Periodically spray water on the surface road	4.1	4.52	3.42	3.89	246.5	1
Replace by new bag filter.	2.52	2.94	3.94	2.73	79.69	10
Cover the point lack off.	3.57	4	3.21	3.47	159.06	4
Replace bigger suction pipe.	2.94	3.1	3.26	2.73	81.11	9
Modify the dust collector system in bag car	2.47	2.31	3.79	2.52	54.49	15
Wearing ear protection	4.21	4.21	2.89	3.73	191.06	3
Install sound choker on compressor	2.84	3.37	3.42	3.05	99.83	6
Build up the separate operation room	2.57	3.1	3.1	2.89	71.37	13
Rising maintenance operating	3.1	2.84	3.21	2.94	83.08	7
Change compressor	2.16	3.1	3.52	3.21	75.65	11
Install pre heater	2.42	2.63	3.47	2.79	61.61	14
Install recovering residue temperate in heater	2.21	2.05	3.52	2.68	42.73	16
Install pre crusher and filters	2.73	3	3.31	3	81.32	8
Applying Hard Regulation	3.57	3.57	3.82	2.63	128.04	5

Install a new waste collector system	2.63	2.68	3.84	2.73	73.88	12
Training for employees related to waste oil generation	3.84	4	3.78	3.36	195.08	2

Monitoring and review:

Internal audit reports and assess compliance with legal requirements and other requirements that the organization is committed applied.

1. Internal audit report:

- Internal audit was conducted on 17 and 18 may 2014, as the non-compliance of environmental management system follow:

- Non-compliance at this stage should be identified and appropriate corrective action taken on them.

2. Report meetings to assess compliance with legal requirements and specified non-compliance in this respect to assess compliance with the requirements of environmental law based on the identification and registration procedure legal requirements, assess the compliance with legal requirements and procedures and aspects of identified risks, as discussed below have.

2.1.1. Performance monitoring and self-reported in accordance with rules and requirements administered by the Department of Environment every six months, based on the results in all cases the expected environmental organization, the company has been consistent.

2.1.2. In relation to other legal requirements relating to the environment in accordance with the accepted procedure of registration and monitoring of conformity assessment done.

IV. Conclusion

Technology development altered range of human life. However, due to the lack of consistency harmful effects of technology on the natural interaction, gradually turning the control vital imbalance actually suffered the effects of these disorders will be affect the man as part of nature. At the global level, especially in developing countries, issues such as population growth, economic and cultural poverty and lack of environmental programs, they will be broader problem of environmental conservation. In our country to find a reasonable and effective solution of all harmful agents in the environment must be identified and evaluated. Then measures and by taking them to a comprehensive environmental management plan be developed at the country level. So, in order to improve the quality of the environment in Kurdistan Cement Factory, two techniques, environmental management systems and green productivity are integrated. Therefore, the first step to form a team and then identify environmental problems techniques and environmental causes of them in the factory and then to solve these problems strategies proposed by the executive team and the experts in the field using the options suggested took priority. It was found that the priorities of options water splashing on the rocks before loading and unloading of the highest priority and should be in the field adopt necessary measures.the proposed solutions were prioritized.

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