

# PERSPECTIVA

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## Case study on “Gypsum Handling” in a Process Plant

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### Abstract

The case discusses about a fertilizer Plant producing fertilizer with two main intermediary Plants of Sulphuric Acid and Phosphoric Acid which are normal inputs for the manufacture of Fertilizer as they provide the nutrient of “S” (sulphur) and “P” phosphorous needed in a fertilizer. It is also common that when Phosphoric Acid is produced, a bye product in the form of ‘Gypsum’ is also generated. Though this by-product does not go into manufacture of the fertilizer, it comes out as a waste but has certain useful applications in Cement industry, agriculture etc. which can be commercially leveraged. The focus in the case is about the way this by-product (Gypsum) is handled by the factory as it has the potential to pollute the environment especially the land and thereby water as well.

The case while focusing on the core issue of environmental impact also touches upon the challenges the industry face when there is an expansion takes place in the form of a project involving capital expenditure.

The case emphasizes about an existence of an opportunity arising out of such challenges. The product ‘Gypsum’ which posed such a challenging issue can also be exploited commercially to the advantage of the organization as it has certain useful applications in other sectors.

*Keywords:* Environmental Pollution, Gypsum, Fluorosis, Gypsum

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## **Introduction**

The Plant General Manager had a torrid time on that day. He was rushing to his corporate office situated in the nearby city to update the happening and for consulting with his boss. The problem was that there were a small group of villagers gathered in front of the factory claiming that the acid Plant is polluting the environment especially the land and water due to their dumping of Gypsum in the back yard of the factory. Gypsum is a bye product (a sledge like powdery material) when phosphoric acid is produced. The villagers claim was that it is causing “Fluorosis” a kind of disease that can cause Teeth distortion due to excessive fluoride contamination.

The groups dispersed after the factory officials explained that the company is not causing any pollution and they have conducted various tests on water in the past and even now taking periodic samples and ensure that they are not causing any pollution to the ground water.

## **Historical Background**

The fertilizer Plant was established in 1966 and the management belonged to a value based group and managed by professionals. Fertilizer Plant was recently upgraded to a higher capacity to achieve economy of scale and also to improve their market share. This necessitated the need for up gradation of phosphoric acid and sulphuric acid Plants also which were the intermediary plants that feed the fertilizer Plant. All the Plants have just stabilized and are providing the volumes to the designed capacities.

While the Plant capacities have increased the storage yard for dumping of the gypsum was maintained at the old level. The yard will be approximately about 3-4 acres. Incidentally gypsum is a sludge coming out while the manufacturing of Phosphoric acid. Acid, and is widely used by cement manufacturers.

The plant gets additional revenue by selling the gypsum (a waste) coming out of the production of Phosphoric acid. acid. There will be always a mismatch of generation of gypsum and the sale of gypsum lifted by cement manufacturing companies resulting in accumulation of gypsum in the yard. However there are occasions the gypsum yard is empty if the acid plant is shut down for a long period but such possibilities are rare now, as focus is now on fuller utilization of the designed plant capacities.

## **Gypsum – a waste that is in demand in the market**

Manufacturing of cement involves addition of gypsum in a small percentage with the cement, as gypsum helps in enabling the settling capabilities for the cement. Pure cement cannot be used in the application and requires gypsum as settling agent. Cement Company’s normally position their Lorries and lift the gypsum from the Phosphoric acid manufacturing fertilizer company’s. While the cost of gypsum is in the range of Rs. 200 to Rs. 350 per MT, the Cos incur major portion for the transportation of gypsum which is in the range of Rs. 600 to Rs. 700 per MT. The freight element will be fluctuating widely during seasons especially during mango season when lorry availability will be scarce. Hence all the cement companies will be procuring the gypsum based on their lowest landed cost and not on the basis of per MT cost of gypsum.

Current scenario: Subsequent to the incident of villagers making a hue & cry about the fertilizers Plants operation the Pollution Control Board started visiting the fertilizer factory frequently. They have installed their own equipment both within the factory and around the factory .Media also highlighted these events periodically as and when escalations were observed. Pollution board found no evidence of pollution so far but suggested using of impervious lining in the gypsum storage yard. The methods of measuring the pollution of the ground /ground water involve periodic verification of the contents of the ground/soil and ground water. The decision to opt for “leach” test model is because the above verification is built on such model. Also the plant emits the process vapor into the atmosphere through a “stake” which also is subjected to verification for air pollution as the contents are likely to be “chemical” gases in the form of vapours. An Equipment called “scrubber” is installed to route such vapours into scrubbers which absorbs such gases into the water and thus prevent them into escaping into the atmosphere. To prevent water pollution the company also commissioned a water Effluent treatment Plant which treated all the process waters before letting them out into the ground. To prevent noise pollution the company installed “silencers” which reduced or kept the noise decibel levels to within the acceptable limits.

The company reviewed these events closely and the corporate office and factory officials worked in closer coordination. The company was confident that their operations are safe. However they wanted to initiate additional precautionary steps. They decided to implement impervious lining of the ground by spreading polythene sheet layers and now gypsum is dumped over this layer so that there is no seepage of contents into the ground. Though it involved additional expenditure the Co decided to opt for the same. The gypsum being powdery in nature when dry or pasty in nature when added with water has the natural tendency to percolate into the ground and thereby can cause land pollution in the long run. This can even go to the extent of contaminating the ground water. If water is polluted by gypsum it can cause “fluorosis” a kind of disease that will cause tooth distortion over a long time usage. The impervious lining (plastic sheet lining) if provided will prevent such seepage of gypsum in to the ground and thus prevent land and ground water pollution. They also decided to go in for ISO14000 Certification even though it is not legally mandatory as of now. This certification enables development of environmental management policies and to establish environmental management systems (EMS) .The Company also undertook a major high technology environment audit and carried out a “leach” test model at a huge cost from an internationally reputed consultancy firm and the findings were favorable. Once an EMS system is put in place it mandates continuous monitoring of the processes and also provides for continuous improvement in the process. A periodic environmental audit also is part of such a system which means periodic checking of processes for the possible slippages and to take corrective steps. As a continuous improvement process this will convert itself into systems that prompts preventive steps rather that reactive actions. Management also realized that such international certification not only boosts the image of the company in the eyes of the public but also benefits in improving the environment management system in the long run even though it might cost the company heavily initially. The long term benefit outweighs this initial expenditure.

## Marketing of gypsum

The company felt that gypsum needs to be disposed of quickly so that storage time and stock levels in the yard are always kept to minimum. The demand for gypsum also was favorable and the cement companies were willing to pay as long as the landed prices are within their budgeted estimates.

The other issue was that local cement companies preferred to avoid buying gypsum from this co due to high local tax which was in the range of 12% resulting in high landed cost as against the interstate tax of 4% against c form,. However the cement companies in the neighboring state found buying from this company as attractive as they can issue c form and avail 4% against CST which enables them to get the least landed cost provided the base price is not increased. This is because the taxes that prevail in the local state are levied by the state government which invariably are high while the tax levied for interstate movement are less (4% in this case if C form is given). The “c form” is a valid document which enables the company to get the taxes levied at a concessional level.

Having analyzed the situation the fertilizer company listed the following factors which provided them both opportunity and threat.

- Accumulation of gypsum is creating an environmental issue even though the company has initiated a number of steps incurring high costs some due to pollution board's insistence and some on a proactive basis.
- The demand for gypsum by cement companies is regular and by varying the prices periodically they are able to improve the sales off take from both local as well as outside the state. The company has now opted for dual pricing as a strategy, lower price for the local cement companies to offset the high incidence of local tax and a little higher base price due to lowest 4% tax against c form for the outside state cos. This dual pricing strategy thus provides for two sets of prices – one for the local buyers and the other for the buyers from outside the state. The basic price for the local buyers are kept a little lower so that after considering the high local taxes the landed costs are still attractive for the buyer.

Since it is any way a bye product (a waste) the revenue is incidental but company is trying to maximize it, out of all possible avenues as it enables both increased revenue as well as avoidance of pollution as an issue.

The company is also thinking of finding out any other application for gypsum in any other industry other than cement to enhance higher price realization out of a waste bye product. Historical off take patterns suggest that the gypsum has a small percentage of application in the industries like Gypsum Board to make Boards out of gypsum that can be used in the construction industry. It is also used as a nutrient in the agriculture where ‘ground nut’ is cultivated. But these constitute only a small percentage. If the cement Companies do not lift the gypsum in adequate volume the storage yard will start accumulating gypsum which is not a good sign for the company as it may even lead to stoppage of further production till yard stocks are disposed of. The management felt that there is a need to have a marketing focus and to develop a marketing Plan. Management is satisfied so far with the steps taken unless and otherwise fresh issues crop up.

**Questions:**

- 1) What do you think of steps taken by the fertilizer company?
- 2) How would you have approached the issues if you were the Plant General Manager?
- 3) What are the long term steps you would suggest for the fertilizer company?

**ANNEXURE**

*Exhibit I: Standard Operating Procedure for Handling Gypsum*

Department: Gypsum Production SOP #

Division: Phosphoric Acid Plant Effective from Date”

Last revision date:

Approval:

**Purpose:** This standard operating procedure is to adopt the best practices prevalent in the industry so that the activities relating to the handling of Gypsum are done at par with the best of global practices.

**Scope:** This SOP is applicable for both dry gypsum handling as well as wet gypsum as applicable from time to time depending on the mode of gypsum production output.

The SOP is relevant from gypsum production output and till it is eventually disposed of. The scope also covers the role of the production department, gypsum marketing department and the department of Safety, Health and Environment and includes contractors engaged in this connection from time to time.

**Pre-requisites:** The gypsum storage yard is fully covered with Polythene sheet layer fully ensuring that there is no room for seepage of the gypsum onto the ground.

**Responsibilities:** The phosphoric Acid Plant is responsible for the pumping of the gypsum either in dry form or in wet form as applicable into the temporary storage bin and then to pump the same through the pipelines into the gypsum yard in case of wet gypsum. If the gypsum is in dry form the same is to be captured directly into the Dumper vehicles so that they can be transported to the yard. The dumpers need to have periodic certifications that they are fit for such transportation activity from approved authorities which is scrutinized and cleared by Manager-SHE.

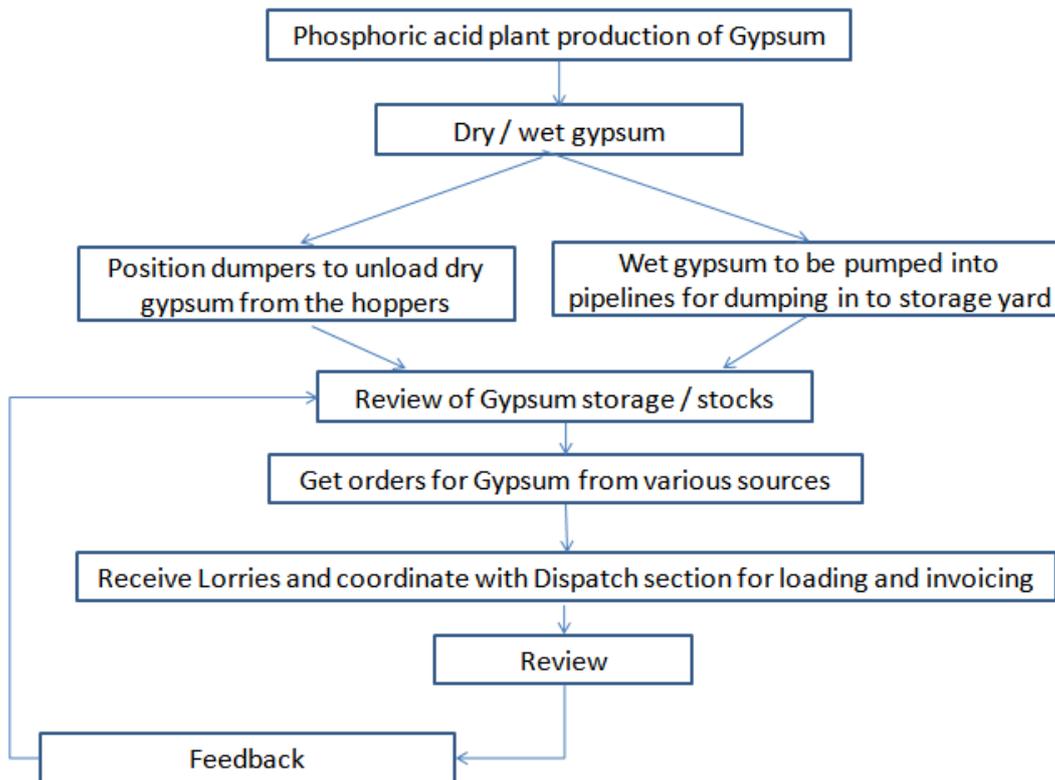
Gypsum marketing is responsible for periodic review of stock accumulation in the gypsum storage yard and makes necessary actions in getting the same disposed of. Any challenges in marketing the gypsum need to be escalated to the management and arrange for review of marketing options so that the production stoppages or over stocking are avoided.

Gypsum marketing department is also responsible for engaging of a contractor to handle activities connected with gypsum disposal on an annual basis and periodic review as necessary for its extensions or to finalize a new contract.

Manager SHE is responsible to monitor that the entire activities of production, storage and disposal are taken care of in an environmental friendly way by complying with all the norms and procedures as specified in EMS of IS 14001.

Manager SHE is also responsible for periodic internal and external audits as specified in the EMS and such audit findings are acted upon by discussing the same in periodic meetings.

**Flow Chart of activities**



*Exhibit II: EMS approval Procedure*

Gypsum storage is a part of Environmental Management system and needs to be monitored on the receipt of gypsum from the Plant and the eventual storage and disposal of the gypsum to various potential customers.

The managing committee of EMS consisting of the cross functional team will review the current system of the gypsum storage and study the “aspects” and “impacts” of such function.

Aspect: Aspect is a task or activity concerned with the gypsum handling in the gypsum storage yard in the course of receiving, storage and disposal of the gypsum.

Impact: Impact is the consequences of the above said activities on the environment.

The team will study the Impact arising out of these “aspects” and categorize the same into appropriate category of grading whether normal or “significant aspect” depending on the impact created on environment.

The team will also come out with an action plan to either eliminate or minimize the impact of such activities and draft a procedure for the same for execution. The managing committee will study the same and incorporate the changes if any and approve such procedure for implementation which will become part of the procedure for compliance under EMS along with other procedures. They will also be subject to periodic audits as per IS 14001.

The owner (in this case the phosphoric acid Plant department) can initiate any review in the approved procedure if required at a later date and seek approval and if approved will form part of the revised document of procedure.

### *Exhibit III: Gypsum Marketing Plan*

The gypsum marketing department is responsible for this marketing plan. The marketing plan will be done on an annual basis covering April to March of the respective financial years of the company.

The plan will commence with an assessment of the annual production of Gypsum for the plan period and possible ways of disposing the gypsum based on the past trend of off takes by various customers.

The plan will address TWO major objectives.

1. The marketing plan will aim for an increased realization of the sales compared to last years and will be set as a target. This can be in the form of realization per ton.
2. The marketing plan will also aim for diversification of the customers apart from the traditional consumption patterns by way of newer application for gypsum usage which will also be set as a target. This will be set as % of new applications of gypsum out of the total sales volume.

The marketing team will arrive at the budgeted estimates with the inputs from the production team of the phosphoric acid which will form the basis for arriving at the overall availability of the gypsum for sale during the plan period.

The marketing team will make an extensive study of the market by visiting the various existing customers, their plans for the coming years; the competitor’s plans, their volumes and their rates etc. and arrive at the feasible realization per ton.

This study will also cover the possible newer applications for the Gypsum on an on-going basis.

The marketing plan will then arrive at the estimates indicating the same both on volume basis and Rupee realization basis which on approval will be frozen and acted upon during the period.