

Development of Waste Management Culture

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ABSTRACT

Development of any culture is a time consuming exercise. However, the civilized world has been developing different kinds of cultures depending upon the necessity of the time prevailing. The development of waste management /minimization culture is the need of the day and the techniques opted are obviously of pollution prevention/control. Pollution generated by anthropogenic wastes has grown to horrifying levels. Though the subject is vast and general, the scope of the paper has been confined to the industrial sector only. Zones of improvements are varied and numerous like energy, raw materials, process conditions, waste generation etc. Inculcation of waste minimization culture amongst workers and managers has been discussed. Since development of a relatively new culture is a prolonged process, it has to be introduced in the grass root level from the very beginning. However, it is never too late to introduce such waste management/ minimization techniques in to the present industries.

Key Words : Waste management, technology, Bayer process, waste management audit

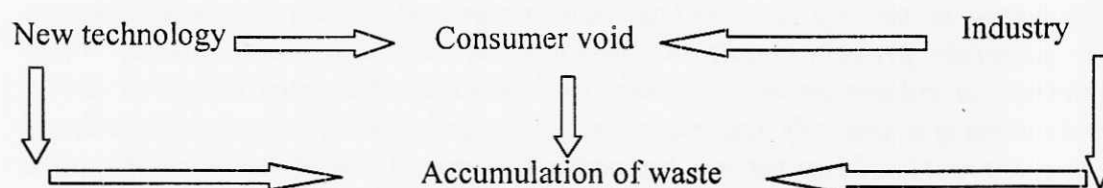
INTRODUCTION

Development of any kind of culture is a time taking process. Any culture can be developed and nurtured once motives are clear. Basically all human cultures thrived on developing a good congenial society with the attitude of "live and let live". As per the analogy when we talk of development of waste management culture (DWMC) our motive behind is to bring down the wastage following clean habits with man as well machine and thus to improve the efficiency of the processes.

The ultimate aim of such an exercise is pollution prevention but not at the end of the pipe line which is neither effective nor economical. Waste management should be attempted all over the pipeline. Waste minimization/management and waste utilization are synonymous to pollution prevention. These terms are coined by technologists and policy makers since pollution prevention and pollution abatement are prohibitive words for any industry. The very term pollution conveys to the society that the industry is polluting. We must understand that the exercise of DWMC is a technical exercise on the foundation of human psychology of sharing equal responsibility. It is a collective effort and any individual not cooperating may invite harm rather than the benefits. This becomes the responsibility of the manager to motivate all for the accepted noble cause.

Once our motive is clear, which is pollution prevention, we should understand and recognize the problem to tackle it squarely. Culture when developed and accepted becomes more or less mandatory for king as well as subject, ruler and the ruled, manager and the managed. One of the important points in DWMC is to pass on the message that rules are equally important and applicable to the broad spectrum of personnel starting from the manager to the managed in an industry. This is more relevant when we refer clean habits at the shop floor as well as in the office.

We are aware and quite familiar with the term "Pollution". An element/compound/material when found at an undesired place and imparts undesired effects is known as pollutant. Pollution levels are going dangerously high and in this context a statement by Prof.H.S.Ray, Editor of *Every man's Science* is most relevant that "Even vultures who thrive on dead bodies are dying". The statement is indicative of the present situation and demands all out efforts from society to arrest this vicious circle of consumption and production. Unfortunately in modern periods consumer index of a country is taken as index of development. It is for this reason domestic as well as industrial wastes are increasing at an alarming rate. There is explosive increase in consumerism that creates a vacuum in consumer society, which in turn, attracts or compels industry to increase production and follow new technology for new products. We may have to mend our consumption pattern in future but for the present we can follow DWMC. The present trend can be graphically represented as:



The pollution scenario of each country is different for obvious reasons depending upon raw material, technology, geological and ecological setup etc. In India, the government has identified 17 heavily polluting industries along with critically polluted areas and river stretches. To all these industries DWMC can be successfully applied since old and obsolete technology can hardly be changed. All these industries are working day and night to satisfy the consumerism of society.

The identified heavily polluting industrial sectors are: Cement, Thermal Power Plant, Iron and Steel, Fertilizer, Zinc Smelters, Copper Smelters, Aluminum Smelters, Oil Refineries, Distilleries, Pulp and Paper, Pharmaceuticals, Dyes and Dye Intermediates, Pesticides, Petrochemicals, Tanneries, Sugar and Basic drugs. These units are spread all over the country resulting in 13 critically polluted areas and 12 polluted rivers.^[1]

ISSUES IN WASTE MANAGEMENT

Recognition of Waste

It is one of the most essential and initial points. Waste is generated from industry when a known technology is utilized to extract useful products from any raw material. We have not been following zero waste concept. Obviously to reach zero waste technology for any industry, it may take a few decades of R&D efforts. The waste generation points should be clearly indicated in the process flow-sheet if it is drawn out honestly. No waste, howsoever small in volume, should be ignored. Supposing one has a hazardous waste and does not want to make it public, it will stay and grow as a cancer in the industry. The recognition should be quantitative as well as qualitative. This will also give insight to the type of pollution created at different sites.

The best judge in this regard is the worker at the end of the chain since all the wastes pass through his hands. In case of separate units inside the industry, persons working in that unit should find out the waste generation points. The wastes are to be analyzed qualitatively and quantitatively by scientific and technical staff under the guidance of the R&D unit. Managers are to collect and scrutinize the list of waste generation points in terms of man, materials and money losses.

Classification of Wastes

Sincere recognition of waste makes the subsequent job of classification easy. Classification is to be done between hazardous and non-hazardous wastes, i.e., safely disposable or indisposable wastes, whether the waste is amenable to treatment, R&D efforts required for safe disposal etc. This classification also has to be done at all levels. US EPA through its number of projects has identified a number of liquid hazardous wastes that can be thermally decomposed, adsorbed or stabilized through chemical treatment.^[2]

Reasons of Waste Generation

Each related unit members collectively have to come up with reasons for unconventional or unforeseen waste generation. The reasons are categorized into human, managerial or technological. This exercise is controversial and each group would like to put blame on the other and vice versa. Here managerial concept of one family prevails if the seniors are generous and ideas are honored with an objective view than the persons.

How to Deal with Wastes

The exercise of dealing with the wastes has to be followed after waste recognition, waste classification and reasons for its generation. Once the above exercises are done sincerely, dealing with waste becomes easy. Human errors are taken care of by better working conditions and environment. Managerial problems can also be tackled by improving the working policies. A good amount of waste minimization can be carried out by the above two approaches. Priorities should be given to the ideas of the workers at end of the chain while working on the above approaches. They are the right persons to understand and solve the problem once they are involved in the system of DWMC. While doing this kind of job we should accept the best idea and honor the person, but if idea is not practicable we should challenge/discard the idea and not the person. We should be very careful in this matter. Mostly the concept of competition goes so much into our head that thought of cooperation never occurs.

The most difficult task is to deal with waste generated due to technical reasons since the waste is generated in spite of a thorough technical knowledge and know-how. It is indicative of the fact that primarily we are to develop a better technology so that the waste generation is reduced or completely eliminated. One of the basic need is to think beyond the boundaries/ mental block with the concept that there can be always a better option available. In the context of Bayer's process, the bauxite processing generates huge amounts of red mud. We should aim at a technology for the complex processing of bauxite which produces alumina along with pure iron oxide, titania,

silica or sodium silicate and no red mud. We should admit that it is a difficult kind of proposition. A functioning industry will never venture into such a novice technical change. Bayer's process has not been altered for the last 100 years. To adopt such a complex process, technologically sound details should be available. What we need most is to change our attitude towards economy verses ecology. At present under the influence of consumerism, we prefer better economy and poor environment in place of poor economy and better environment. However, this has been challenged by experts and it can be concluded that if environment is preferred over economy in the long run it would pay attractive dividends.

In this regard a secondary approach like 'utilization of waste product' is very much relevant. While attempting waste utilization any treatment /reaction carried out should not make any desirable /undesirable change in the production stream which is mandatory in the primary approach. In the secondary approach of waste utilization most essential requirements are vision, knowledge of waste, knowledge of geography as well as geology of the disposal area with a thorough R&D background. Nature does not support anything as a waste. We are heading towards a situation in which nothing is waste material. It is either a misplaced resource or indicative of our lack of technical knowledge to utilize it. A number of things earlier considered waste have now been turned in to useful products; e.g., cow dung have been turned into a source of energy as well as fertilizer. Here, in this approach only R&D laboratories come to picture and it has good number of success stories, i.e., slag cement from steel plant-slag, fly ash bricks, dry disposal of the red mud, vanadium pentoxide from vanadium sludge of aluminum industry and many more. For example, in the Bayer's plant of extracting alumina from bauxite, there are several operational and other potential problem sources as listed in Table-1 along with their possible environmental impacts.

Table 1 : Operation, potential problem sources and possible environmental impact of the Bayer's plant

Operation	Potential problem sources	Possible impact on the environment
1. Storage	i. Fuel oil	Fire hazards and water pollution of spillage that may disturb fishery and aesthetic values
	ii. Caustic soda	Corrosive irritant on contact and disturbance to pH of water body
	iii. Bauxite	Dust as source of air pollution
	iv. Limestone	Dust
	v. Burnt limestone	Dust, irritant
	vi. Acids	Corrosive and damage to skin and respiratory tract
	vii. Sodium sulphide	Corrosive and ability to generate corrosive and poisonous hydrogen sulphide
	viii. Flocculants	Slippery on spillage

Table 1 contd.

Operation	Potential problem sources	Possible impact on the environment
2. Grinding and crushing		Noise and dust
3. Wet screening	Over sized material	Slurry can disturb receiving water body if discharged improperly
4. Digestion, sedimentation and washing	Residue, pre-heater washing	pH and bulk of the material can be the source of water pollution. Increase of suspended solids and pH alteration may disturb fishery
5. Calcination	Stack gases	SPM, SO ₂ and NO _x generated may affect air quality and lead to acid rain
6. Steam and electricity generation	Impurities in oil and coal and incomplete burning	SPM, SO ₂ and NO _x
7. Lime burning		Air and water pollution
8. In-plant material transport	Bauxite	Dust from open conveyor belt lead to air pollution
9. Domestic water		Water pollution
10. Cooling water	Over-flow or blow-down	Addition of Cr and P chemicals cause water pollution
	Caustic soda and organics entrained	Bad smell
11. Evaporator cleaning	Acid liquor	Change of pH may disturb receiving water
	Sodium oxalate scale	Toxic material
12. Equipment washing		High turbidity, salinity and soda content as a source of water pollution
13. Supporting	Steam pressure relieve equipment valve, air compressor stations, vacuum pump turbines	Noise pollution

Waste Minimization Audit

A regular and periodic waste minimization audit should be conducted internally by the industries to keep a tab on what is happening to the wastes generated. As an example let us take the case of an aluminum plant and see how the waste minimization audit proceeds logically in the flow diagram [Fig. 1]. There are also possibilities of recycling wastes in an alumina smelter as depicted in Fig. 2.

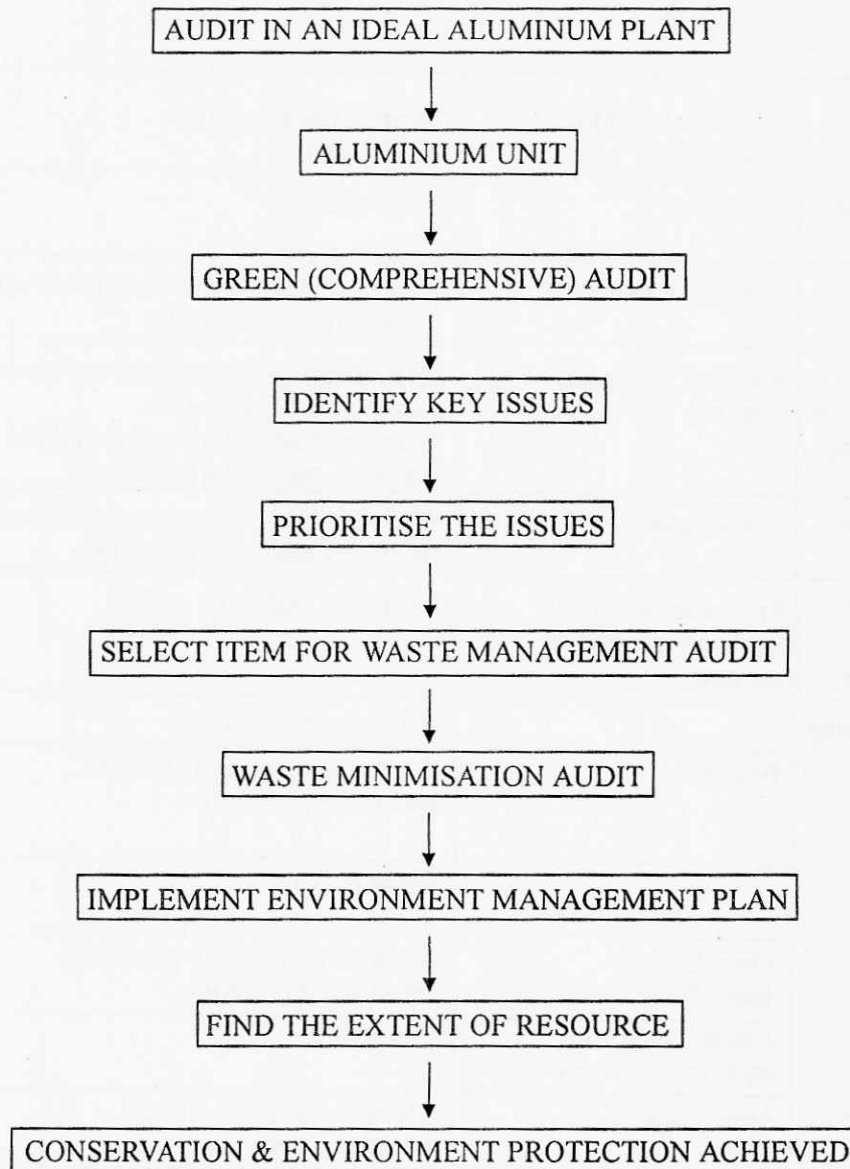


Fig. 1 : Flow diagram for waste minimization

CONCLUSIONS

Industry is an economic unit and everybody is paid as per his capability to contribute to the productivity. DWMC without a similar goal can not fit into the system. The end result of DWMC has to be translated to economical gains and judicious distribution of the gain among all the employees. This incentive only is not sufficient. Workers with innovative ideas should be honored. DWMC has to be made routine once or twice a year so that the culture gets set and becomes example in its own way. More or less every industry has a scope for DWMC and the end results are sure to be positive. This exercise is not being followed in India but moderate beginnings have been initiated in some industries with the help and cooperation of the National Productivity Council.

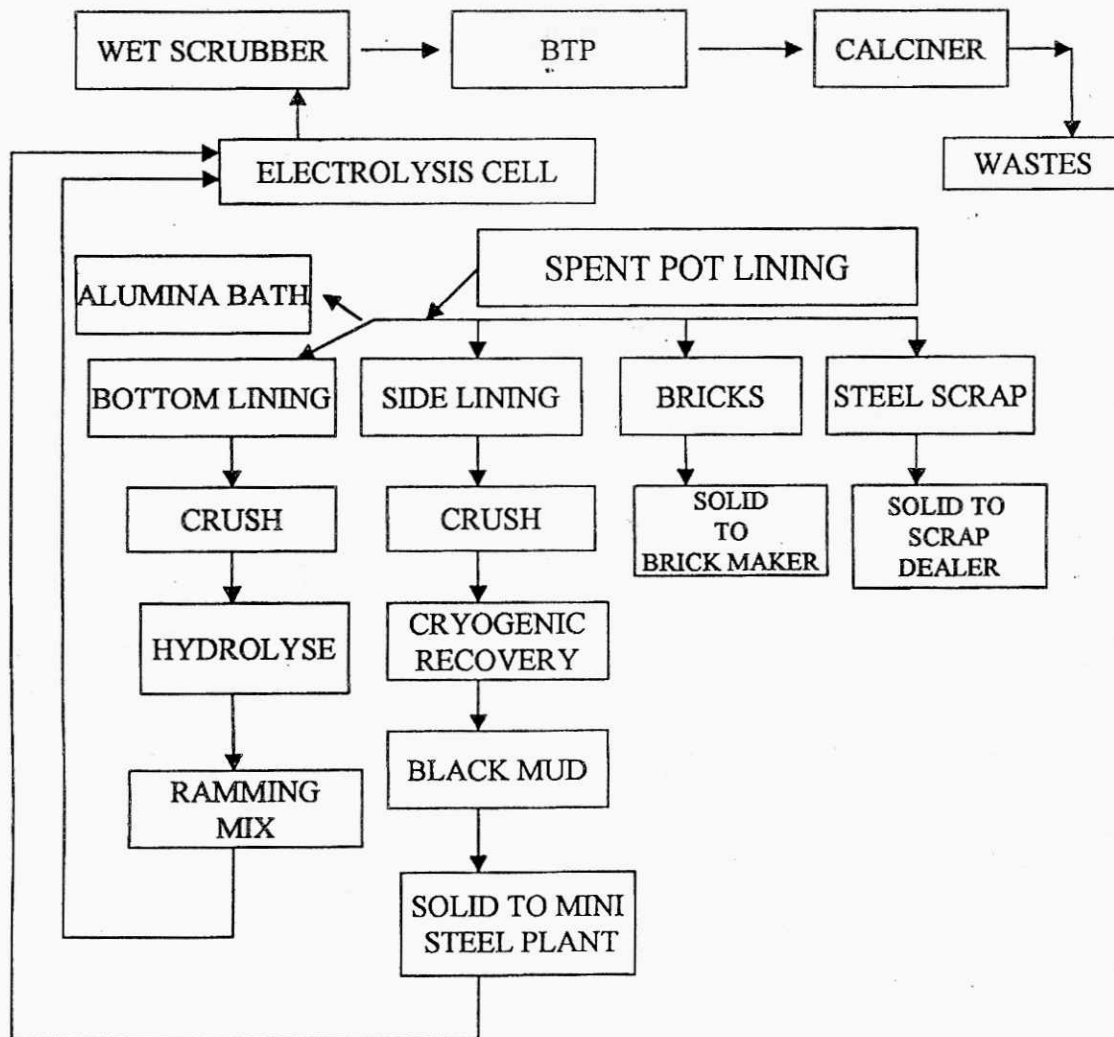


Fig. 2 : Recycling of solid wastes at an aluminium smelter

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