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Sustainable technology through pollution prevention programme

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ABSTRACT

Enormous damage has been done to the ecology of our planet due to industrial growth during the last millennium. Thousands of tons of industrial waste not only represents a significant loss of raw materials but when discharged into air, water and land, that also threaten the human life and ecosystem which cannot tollerate such pollution. Hence the need for sustainable technology which can be obtained through carefully considered pollution prevention programme.

Science Advisory Board of the U.S. Environmental Protection Agency, recommended that "EPA should shift the focus of its environmental protection strategy from end-of-pipe controls to preventing the generation of pollution". If business, government, controlling agencies and citizens groups could approach the pollution prevention in a 'voluntary' 'protective', and 'co-operative manner' rather than secretive, evasive and distrusting manner currently prevailing, then the aim of sustainable development is easily achievable.

From business perspective, a number of benefits can be obtained by adopting a pollution prevention programme. A brief description of pollution prevention is given in this paper.

Keywords : Materials efficiency, Sustainable development, Pollution prevention, End-of pipe control.

INTRODUCTION

It involves in-plant practice that reduces the quantum of pollutants or eliminates the toxicity of pollutants which otherwise would have been released to air, water or land through the waste streams of the plant. In practice, pollution prevention is achieved by the designs of the products and processes that lead to less volume of waste and less toxic waste being produced. In regard to pollution

prevention, any manufacturing industry should participate in it as it:

a) generates waste
b) emits or discharges this waste into the air, water or land
c) handles hazardous materials
d) has the interest in saving money by reducing waste-handling cost, raw materials cost and production cost.
e) has the intention to operate in an environmentally responsible manner.

INCENTIVES OF POLLUTION PREVENTION

The manufacturing industry that implements the pollution prevention programme will:

a) save money in the long run by savings in disposal and raw materials costs which will reduce the overall cost of operations.
b) improve environmental and work place conditions which may lead to savings in workers' personal protective requirements, less absenteeism, better productivity and also to better community relation.
c) increase the profitability by more efficient use of raw materials due to improved processes and operations
d) reduce present and future compliance costs due to the elimination in some cases, the need for permits, monitoring and reporting
e) improve the company image which will help in selling the products.

OBSTACLES TO POLLUTION PREVENTION

Depending upon the size and nature of the manufacturing unit there may be a number of obstacles to the implementation of pollution prevention programme. Some of these are :

a) pollution prevention involves capital investment which may not be easily available especially for small industries
b) attitude of the company which generally has the inherent reluctance for any change.
c) personnel requirement for the implementation may be beyond the capability of small industries
d) The technical expertise for implementation may not be easily available
e) different process and different quality perception may not be acceptable

to the established customers who already has a specification standard.

SUGGESTED STEPS FOR IMPLEMENTING THE POLLUTION PREVENTION PROGRAMME

The suggested steps to establish and maintain a pollution prevention programme are :

(a) educate the top management about the programme to obtain the support

(b) review in detail the existing manufacturing process to determine:

  (i) raw materials used

  (ii) sources and character of waste generated.

(c) identity potential pollution prevention opportunities.

(d) determine the current costs of waste management and make an educated guess about the future costs

(e) estimate the cost requirements involving the capital and personnel costs for pollution prevention

(f) select the best possible option for pollution prevention

(g) start the programme by developing a written pollution prevention plan and by training employees about it

(h) maintain and sustain the pollution prevention programme with continuous monitoring about techno-economic requirement for future changes.

It should be noted here that ISO : 14000 has incorporated pollution prevention programme with their quality assurance programme of ISO : 9000. The implementation of pollution prevention programme follows the pattern of ISO: 9000.

SOME EXAMPLES OF POLLUTION PREVENTION PROGRAMMES

General Pollution Prevention Programmes

1. A company in the United States shut down its plant for manufacturing organic solvents which produced hazardous wastes. It now manufactures solvents with water base that do not generate hazardous wastes. These cleaner solvents are now in great demand in the USA and the company has a better turn-over.
2. New synthetic methods are being developed to avoid toxic feed materials in the production of large volume commodity chemicals. Polystyrene is a widely used packaging and insulation material which is made by the polymerization

of styrene. Styrene is produced from benzene which is considered to be carcinogenic. Orville Chapman at the University of California, USA used the technique of intramolecular rearrangement to synthesize styrene without the use of benzene as the feedstock.

Pollution Prevention Programmes Related to Non-Ferrous Industries

1. Before casting, all aluminium alloys have to be degassed to avoid porosity caused by dissolved hydrogen. Currently in Indian foundries, degassing of molten aluminium alloys is done by plunging hexachloroethane in tablet form. Hexachloroethane dissociates to form chlorine which removes dissolved hydrogen from the melt. Hexachloroethane degasser also causes some chlorine gas and hexachloroethane vapour emissions into foundry air. Both these emissions are highly toxic.

   Another method of degassing molten aluminium alloys is by bubbling inert nitrogen gas with a lance. But this process is not very popular due to the fact that it takes nearly 20 minutes as against 5 minutes required for 'hexachloroethane process' to obtain an acceptable level of degassing. The search for environmentally friendly process led to the improvement of the 'nitrogen process'.

   It is seen that instead of stationary lance, if a rotary impeller or lance is used, the treatment time can be brought down to 5 mins by controlling the rotational speed. The process also caused minimum turbulence in the melt which is beneficial for oxide inclusion floatation in the case of aluminim melt. This example illustrates that instead of producing toxic pollutants by hexachloroethane process which subsequently have to be controlled by some control device, pollution is prevented at source through the improvement of an existing process.

2. Leaded Red Brass ASM C83600 and Leaded Semi-Red Brass C84400 are generally used in plumbing work. These alloys contain 5 and 7% Pb respectively and have good founding and machinability properties.

Of late, the American industries have been pressurized by the US Environment Protection Agency (EPA) to reduce human exposure to lead in all industrial activities. The use of lead in brass foundries causes lead emissions in foundry air at melting and pouring stations and also can contaminate the foundry sand to the level not acceptable to EPA standard. In addition to this, there is the possibility of lead-leaching from plumbing articles into drinking water which makes it is unsuitable for human consumption since allowable Pb in drinking water is set at very low level.

In order to circumvent this problem, SeBiloy I (C 89510) and SeBiloy II (C 89520) containing only about 0.25% Pb were developed by a group of companies headed by AFS. These alloys replace leaded red brass and leaded semi-red brass and contain 0.5 to 2.5% Bismuth and 0.35 to 1.2% Selenium in place of lead. Bismuth which is added to obtain good machinability is non toxic to humans unless consumed in massive amount. Selenium is added to enhance the effect of bismuth. Like copper, selenium is required as a nutrient by animals and humans. This is an example where pollution prevention need led to the development of environment friendly alternative casting alloys.

CONCLUSION

It is clear from the above that pollution prevention is the only solution that an industry can undertake both from economic and environmental view points. This is also emphasized by the comments made by the administrator of US Environmental Protection Agency William Reilly who said "We have learned the inherent limitations of treating and burying wastes. A problem solved in one part of the environment may become a new problem in another part. We must curtail pollution closer to its point of origin so that is not transferred from place to place."