Environmental Pollution Inhibition Tactics

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ABSTRACT

Economically efficient environmental organizations need the adoption, of a defensive strategy because of old pollution controls, transference of pollution from one medium to another, and consumption resources out of proportion to the profits accrued. Pollution is that portion of resources that cannot be utilized with current production ability implying that excessive pollution is a gross wasteful use of resources. Accountability deceits the industry as it is a major user of resources. An attempt has been made to report a pragmatic management tool, which reports it to help an industry or operation to verify compliance with environmental necessities.

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1. INTRODUCTION

The environment, with its biotic and abiotic elements, provides the fundamental assets that supports manufacture-utilization actions and integrates the residues produced there from. As is evident from figure 1, the assimilatory ability of the environment is closely linked with its supportive capacity. Resource use patterns, therefore, largely determine the nature and extent of emerging environmental problems within a given economic and policy framework.

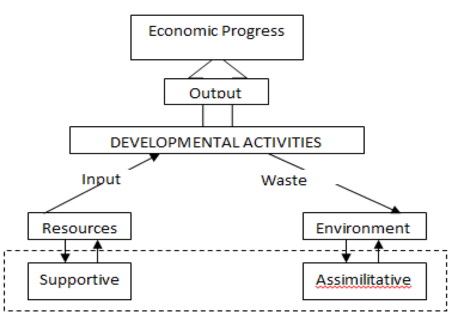

Figure 1: Economic and policy framework.

Pragmatic management of natural resources requires positive and realistic planning that integrates human expectations with ecosystems carrying capacity. Such an approach not only brings about environmental harmony but also ensures long-term sustainability of the natural resources base and economic efficiency in resources utilization vital for ensuring sustainable development.

The direction of environmental policy, clearly, needs to be shifted from reactive to preventive intervention through carrying capacity-based planning, environmental reorientation of various economic sectors, inter-sector policy coordination, and effective implementation mechanisms, therefore.

Such as approach, no doubt is guided by long-term gains and it may be argued that while faced with present day environmental problems demanding immediate solution, it is neither feasible nor desirable. This really is a logic because environmental problems that exist today are exactly those which, through a related method, we stopped to resolve years ago.

Against the backdrop of these concepts and ideas, this paper endeavors to suggest pathways for preventive environmental intervention in respect of industrial pollution, hazardous wastes, and macro-scale impacts of air pollution.

2. MATERIALS AND METHODS

2.1 Pollution Inhibition Industry:

The industry in India has been diversifying into progressively more capital-intensive and power demanding areas which are also the very contaminating. Considering the future raw ingredients and energy situations, the impact that the manufacturing and its goods have on the natural resource base and environmental quality, and the fact that resource conservation measures have positive economic and environmental grant is effects; it becomes imperative to have a re-look at our environmental policies and their role in ensuring sustainable industrial development.

Control or Prevention?

Environmental policy for industry in India has focused mainly on 'pollution control' through end-of-the-pipe (EOP) treatment technologies which allow the wasteful use of resources and then consume further resources to solve the environmental problems in a particular medium.

Through the pollution control approach is effective in reducing the concentrations of single types of pollutants; it suffers from several drawbacks such as.

a. It leads to cross-media transfer of pollutants, the most common example being the conservation of air and water pollutants into sludge for which there are no standards in the country.
b. It does not solve the problem of second-generation pollution related to product use.
c. It is a legalistic approach which comes into force after a violation has occurred and, therefore, does not prevent pollution.
d. It does not induce internalization of environmental costs.
e. It is not a cost-effective approach.

As new industries come up, it will be necessary to impose progressively more stringent standards to retain acceptable quantities of conservation value. If the option of more intensive pollution control is to be avoided in the future, then it is necessary to adopt strategy of pollution prevention based on technologies that conserve resources, minimize pollution, and reuse wastes as secondary raw materials to the extent possible.

Small & Non-Waste Machines (SNWT)

Low and Non-waste Machineries are essentially based on improved manufacturing methods that need less raw materials and energy to obtain equitable levels of output of identical or improved quality to produce less wastes. SNWT are usually reliant upon innovation and a high level of cooperation between different industries when exchanges of certain wastes are tangled.

The concept of LNWT incorporates several approaches to waste minimization and waste utilization which broadly fall under three categories, viz. clean technology of industrial manufacture; recover and use again machineries for EOP treatment; and waste utilization machineries.

Hygienic machineries of industrial production are based on tactics such as process changes, recycle/reuse, respectable housekeeping and equipment modification and product reformulation. Recycle and reuse skills for EOP treatment include retrieval of raw materials, energy, and water through EOP treatment of wastes. Waste utilization machineries are used in utilization of the large quantities of industrial process wastes generated in the engineering, metallurgical, agro industrial, chemical, and plastic.

In the developed countries many instances of adoption of LNWT have been documented. In India, application of LNWT has been evidenced in the case of textile, pulp and paper, tanneries, distilleries, metal plating and several other industries. However, the full potential of these technologies has not been exploited primarily due to the absence of effective policies.

Payoffs from Pollution Inhibition

It cannot be denied that pollution control as well as prevention cost money. To clean up an existing polluting operation might take an additional 10 to 15 percent of the original investment. Building 'clean' might add 2 to 5 percent to the cost and the total effect of new investments and operating costs might be product price rise by 1 to 2 percent in the short-term. In the long-term, however, clean technologies lead to direct and indirect benefits for the production as well as the national wealth.

The direct economic benefits of pollution prevention to the industry are obtained from the preservation of reserves and the evasion of contamination handling charges. There is also a 3 to

4 times savings in cost associated with integrated as against add-on pollution control technologies. The avoidance of potential costs of alterations required by future legislation further add to the savings.

Preplanned environmental protection also adds survival of the industry by enhancing its ability to remain financially liquid in a future constrained by more and more stringent environmental standards by conserving natural resources; increasing the viability of its projects; and avoiding conflict.

The most important payoff from hygienic machineries is the creation of new growth opportunities for the industry as well as the national economy in the form of new markets for recovered material, methods, goods, machineries, and new employment opportunities. Hygienic machineries lead to multiple use of resources, multiple product formulation, and internal transfer of wastes from one sector to become the raw materials or energy sources of other. This tactic endorses a high rate of growth since it offers maximum value for given resource input and hence excites the enterprise and national economy.

The Problem of Small - Scale Industries

The major environmental implications in the industry sector arise from small-scale industrial units (SSI). Nearly half of the entire manufacturing production in India is impacted by over 1.5 million SSI units and this sector is growing at the rate of 20 percent per year. The Government has policy of promoting steady growth of the SSI sector and has accordingly introduced a large number of fiscal incentives and other promotional measures.

These efforts are quite justified when one considers the need for creation 120 million jobs in the next 15 years, the present distribution of population and labor force, and substantial investments in social and economic overhead capital required for the absorption of labor in urban areas.

From the environmental point of view, the SSI are estimated to contribute 60 to 65 percentages of the total manufacturing contamination. Though the labor and capital productivity of this sector is comparable to that of medium and large industries, its material productivity is usually lower, thereby resulting in more pollution per unit of output. However, Government thrust in the area of pollution control has been generally confined to medium and large industries due to lack of infrastructure and resources with the PCBs for monitoring and enforcing pollution control laws in the cases of SSI.

Realising the inability of small entrepreneurs to deal with pollution problems, some institutional measures have been introduced in the form of 70 percent rebate in water cessess 5 percent depreciation on pollution control equipment, subsidies on investments in pollution control, soft loans at the rate of 12.5 percent as against 14 percent, and so on. However, the National Small Industries Corporation (NSIC), Small Industries Science Institutes (SISI), State Industrial Development Corporations (SIDC), and other agencies providing assistance to potential entrepreneurs have not given due importance to pollution control aspects. The result is that not a single SSI has so far forward to avail the financial incentives provided by the Government for pollution control.

There is, therefore, need for adoption of appropriate strategies for the solution of environmental problems related to the SSL

2.2 Management of hazardous substances

In the recent years, there has been increase in awareness of the quantity and diversity of hazardous wastes generated by the industry and the risks and dangers posed to human health and environmental quality by some of the disposal methods for such wastes. These concerns have promoted several countries to undertake effective technological, policy and administrative measures to address the problem of hazardous wastes, Despite the substantial progress made in this area, particularly in the developed countries, explicit solutions to many fundamental problems are not yet available.

Definition and Classification

Despite the efforts of various international agencies, and acceptable and comprehensive definition and classification of hazardous wastes is yet to be devised, mainly because of the difficulty in identifying suitable parameters for definition. A working definition of hazardous wastes has been provided by the OECD and the EEC, according to this definition, hazardous waste is any substance which, because of its quantity or physical, chemical and infectious characteristics, can cause significant hazards to human health or the environment when improperly treated, stored, transported or disposed.

Radioactive wastes, though hazardous, are excluded from this definition since most countries control and manage these wastes under separated organizational framework.

Inclusive lists are available in various countries for the identification and classification of hazardous wastes, industrial processes from which hazardous wastes may be generated, and substances, which are indicative of hazardousness. The criteria for assigning substances to these lists include toxicity of the waste or an extract of the waste (usually obtained by means of a specific leaching test), ignitability, corrosivity, and reactivity.

Health and Environmental Influences

Hazardous wastes, affect human and animal health directly through contact or inhalation and indirectly through intake of contaminated drinking water or food. Migration of contaminants through ground and surface waters greatly increases exposure through contaminated drinking water. Chemical contamination of vegetation and crops from a variety of sources such as contaminated irrigation water, application of sludges, and deposition of air emissions results in tropic transfer of hazardous chemicals.

A wide variety of diseases resulting from improper handling and disposal of hazardous wastes have been documented. Children are especially vulnerable group. Hazardous wastes are also known cause carcinogenic, mutagenic, and teratogenic effects.

Hazardous Waste Management in India

In last three decades, our country has witnessed a five-fold increase in industrial production. This has brought in its wake serious environmental pollution problems characterized by release of variety of toxic and hazardous substances. In the highly industrialized pockets, such as Maharashtra and Gujarat, hazardous waste has assumed alarming proportions.

As per the correlation between economic activity and hazardous waste generation established by the OECD, the estimated annual hazardous waste generation in India was about 0.3 million tons during 1984. However, except for sporadic attempts made by CPCB, DOE and NEERI, no systematic assessment of the quantity and pollution potential of the hazardous wastes has been undertaken in our country.

A list of industries generating potentially hazardous wastes in India has been prepared by NEERI and available information has been compiled on the quantity of hazardous wastes from inorganic, organic, petrochemical and biocide industries, the characteristics of the wastes, and the methods of treatment and disposal.

This information reveals that safe guidelines for disposal of hazardous wastes are seldom followed. The commonly used methods of treatment and disposal include incineration of highly toxic wastes and open pit burning for disposal small quantities of sludges. Secure landfilling of containers is practiced only in a few eases while uncontrolled landfilling is more prevalent. Co-disposal along with municipal solid wastes appears to be a rule rather than exception, particularly in highly industrialized urban agglomerations.

Tactics for Management

It is evident that hazardous waste management is still in its infancy in India. Hence it is essential to evolve a comprehensive hazardous waste management program (HWMP) including solid, liquid and gaseous wastes and covering land, water and air environments, with major thrust in the following areas:

a. Development of data base on industry situations with respect of generation, storage, transport, treatment, and disposal.
b. Development of sampling, analysis, and monitoring techniques
c. Studies on treatability of hazardous wastes
d. Development of technology /technique for hazardous waste management
e. Computer aided modelling of hazardous waste fate/transport; and
f. Environmental impact and risk assessment of hazardous waste disposal, arid emergency response/ disaster management.
g. Identification of landfill sites for hazardous waste disposal
h. Guidelines on storage, handling, transport, disposal of hazardous wastes.

2.3 Atmospheric and ecological influences of air pollution

Until recently, pollution was considered as a local problem. In the past decade, however, attention has been focused strongly on the larger scale aspects of air pollution. The products of fossil fuel combustion, vehicular traffic and other industrial process have been linked to global changes, ozone layer depletion, and acidic deposition from long-range transport of air pollution.

Climatic Changes

For more than hundred years scientists have been suggesting that changes in the chemical composition of the atmosphere could bring about climatic changes. The substances that play a major role in controlling the current structure of the environment include carbon dioxide and other trace gases such as ozone, water vapor, nitrous oxide, methane and chlorofluorocarbons. The major sources and sinks of these gases and their concentrations in the atmosphere are presented in Exhibit 1. Theory holds that increase in the concentration of these substances could significantly reduce the failure of current emission from earth and water surface to space out, thus raising surface air temperatures.

The evidence on global warming or the greenhouse outcome produced in 1985 October at a conference organized by WHO, UNEP and ICSU in Austria reveals that if the present 1 to 2 percent average annual increase in carbon dioxide emissions continues, a doubling of pre in industrial carbon dioxide concentrations (600).

The results obtained from most numerical models suggest that a doubling of the carbon dioxide concentration and increase in other trace gases in the atmosphere, would lead to an increase of 1.5 to 4.5°C in the mean global air temperature. About half to two-thirds of this increase could be attributed to carbon dioxide and the rest to other greenhouse gases.

The major impact of global warming could be a rise the sea level by 25 to 140 cms resulting in inundation of low-lying coastal areas and severe disruption of the economic, social and political structure of many countries. Global temperature rise would also slow the atmosphere heat engine thus influencing rainfall regimes. Changes in temperature and precipitation in turn would affect the stability and distribution of the World's biomass, the severity of such impact being governed by the nature and extent of human intervention. As observed at the WMO/UNEP/ICSU Conference, the greenhouse effect will also affect the future validity of many of present day economic and social decisions that assume that earlier climatical records are a consistent drive to the opportunity.

Table 1: Source, Sinks and Concentrations of Greenhouse Gases

S. No.	*Substance*	*Source*	*Emission*	*Mean Atmospheric Concentration*	*Estimated Concentra-tion in 2030*	*Sink*
1.	Carbon dioxide	Fossil Fuel combustion Terrestrial Biota Soils	5x10 tonnes of carbon/years 1.8x10 tonnes of carbon/years 4.5x10tonnes of carbon /year	340 ppmv (1980)	560 ppmv	Oceans
2.	Nitrous oxide	Biological denitrification in soil and oceans	30 million tonnes of carbon/year	303 ppmv (1984)	375 ppmv	---
3.	Chlorofluoro	Industry	4 tonnes/year	230ppmv (1985)	1100pptv	Photochemical

	carbons CFC-11 CFC-12		4 tonnes/year	400ppmv (1985)	1800pptv	Destruction in stratospher; uptake by oceans (very
4.	Methane	Enteric fermentation in ruminants Release from organic rich sediments Production by termites' and biomass burning	550 million tonnes/year	1.65 ppmv (1985)	2.34 pp mv	Oxidation pp by processes

Acidic Deposition

Acid accumulation was first elevated as a worldwide question by the Scandinavian countries at the UN Seminar on Social Natural environment at Stockholm in 1972, Since then, it has settled into a main worldwide conservation issue and a great deal of knowledge has been generated on the subject. The WMO Background Air Pollution Monitoring Network (BAPMoN) supported by GEMS regularly reports data related to precipitation chemistry from 55 stations. Acid precipitation has also been reported in India.

The main sources of acidifying substances in the atmosphere are sulfur and nitrogen compounds emitted from power plants, industrial processes, vehicular transport and domestic sources. Natural sources also contribute acidifying substances to the atmosphere.

Acidification of the environment occurs in several ways. Compounds such as sulfuric and nitric acids in precipitation contribute acidity direct to the receptors on which they fall. Other pollutants such as sulfur dioxide and ammonium compounds cause acidity through chemical or biological reaction in receptors. In other cases, displacement of hydrogen ions from soil mineral lattices and subsequent transport to surface or ground waters may cause acidity.

Each region receives part of its acid fall-out from its own pollutants and the rest from long range transport of pollutants from other regions. Acid deposition from long-range transport depends on the residence time of pollutants in the atmosphere. In the case of sulfur and nitrogen compounds, deposition may occur up to a few thousand kilometers away from the source.

The major adverse impacts of acidic deposition on the ecosystem include changes in primary productivity of water bodies resulting in loss of fisheries; leachate of toxic and other metals from water distribution systems resulting in deterioration of water quality; change in soil properties thus affecting forest and crop yields; damage to forest from direct deposition; corrosion of construction materials; and diverse pulmonary effects in sensitive individuals,

Ozone Layer Depletion

Ozone is present in the upper atmosphere in trace amounts and serves as a natural filter for absorption of the short wavelength ultraviolet solar radiation which is harmful to life. Ozone is a highly reactive compound which is produced as well as decomposed in the atmosphere through a complex series of chemical reactions.

Certain substances of anthropogenic origin are known to upset the balance between the manufacture and demolition of ozone thus leading to changes in the entire volume of ozone above the earth’s surface. Among these are the chlorofluorocarbons (CFCs) and nitrous oxide (each of which can act to reduce ozone), and nitrogen oxides from commercial subsonic aircraft, methane and carbon dioxide (each of which can increase ozone).

The release rates and concentrations of some substances that deplete the ozone layer are presented in Exhibit 2. Substances such as CFC-11, CFC-12, carbon tetrachloride and methyl chloride are relatively inert in the lower atmosphere but are converted by UV radiation in the stratosphere to form the ozone-destroying catalyst, atomic chlorine. Likewise, bromine from methyl bromide, ethylene dibromide (FC-1301) and Bromofluocarbons (FC-1211) also lead to significant reduction in stratospheric ozone.

Table 2: Release Rates Concentrations of Substances Affecting the Ozone Layer

Sr, No.	*Substance*	*Release Rate (million kg/year)*	Mean *Atmospheric concentration*	*Annual Rate of Increase (%)*	*Atmospheric Residence Time (years)*
1.	CFC-11	260	230 Ppmv (1985)	65	565
2.	CFC-12	420	400 ppmv (1985)	110	5
3.	Carbon Tetrachloirde	120	125 ppmv (1985)	25-50	1
4.	Methyl Chloroform	500	130 ppmv (1985)	8	7
5.	FC01301	--	0.003-0.004 ppmv (1984)	110	10
6.	FC-1211		0.003-3-0.004 ppmv (1984)	25	10
7.	Methyl Bromide		0.007-0.021 ppmv (1984)	3	

Changes in ozone layer have been studied through hypothetical models of the natural and organic processes involved. Reports by WMO, NASA and UNEO indicate that if the production of CFCs continues at the existing cost, there be a decrease in total worldwide ozone by about to a lesser extent than 33 percent around the later 70 years. If the issue proportion of CFCs doubles or the stratospheric chlorine reaches 15 pp by (from 1985 levels of 2.5 pp by), it forecast that there will be a 3 to 12 percent lessening of the ozone layer, presumptuous that the yearly increase in concentrations of, methane, nitrous oxide and carbon dioxide will remain at existing charges.

It is believed that one of the impacts of ozone depletion in the upper stratosphere and associated increase in the lower stratosphere and upper troposphere could be reinforcement of the greenhouse effect of carbon dioxide.

The other major impact of ozone depletion would be the deleterious biological effect caused by an increase in incoming UV-radiation. It is estimated that a 1 percent decrease in upper stratospheric ozone could lead to a growth of about 2 percent in UV-B emission which will kill microorganisms outright and destroy individual cells in plants and animals. Social condition is affected by UV emission in many ways, for example, by the occurrence of suntan, eye disorders, immunologic changes, photoallergic effects, and skin infections including skin tumor.

3. RESULTS AND DISCUSSION

3.1 Strategies for Inhibition of Industrial Pollution

A major factor that discourages entrepreneurs form prevention pollution is the perceived risk associated with the relatively new clan technologies in many cases, such technologies may not even have been developed or sufficiently tested. The small-scale industries neither have the awareness nor the financial and infrastructure capacity to deal with pollution problems. Then, of course, there is the tendency of industry to avoid environmental costs in favor of short-term gains. A combination of informational, institutional, and policy measures, therefore, need to be devised for prevention of pollution in the industry sector. Some strategies for prevention of industrial pollution could be.

a. Provision of financial aid for R&D on LNWT and installation of demonstration plants on LNWT
b. Creation of centralized data base on LNWT
c. Introduction of effluent charges and other types of waste/resource taxes to internalize environmental costs and thus induce the development of clean technologies and adoption of waste treatment measures.
d. Provision of economic incentives such as subsidies, loans and tax rebates to promote LNWT
e. Formulation of sludge standards to minimize cross-media transfer of pollutants
f. Formulation of effluent and emission standards in terms of total discharge per unit quantity of raw materials or product so that polluters are not discouraged from adopting waste reduction strategies.
g. Classification of SSI into polluting and non-polluting industries and provision of incentives to non-polluting SSI on a preferential basis.
h. Ecological grouping of polluting SSI and provision of joint treatment facilities.
i. Planning of industrial estates based on EIA
j. Location of economic activities which create wastes near those which can utilize these wastes
k. Development of improved procedures for environmental review to ensure that environmental concerns are incorporated in all industrial projects.
l. Formulation of appropriate energy and raw material pricing policies for industry
m. Decentralization of the planning process to develop supportive and assimilative capacity based regional plans and to ensure participatory planning.

3.2 Strategies for Management of Atmospheric Issues

The prevention of atmospheric problems discussed above requires a coordinated endeavor by all countries towards

a. Enhanced examining and evaluation of the developing trends.
b. Enhanced research to enrich knowledge about the causes, processes and impacts of the trends
c. Progress of worldwide approved strategies for the decrease of the relevant gases.
d. Development of tactics to reduce the loss and manage with the impacts.

This four-pronged strategy was recommended at the WMO/UNEP/ICSU conference on greenhouse effects at Austria in October 1985 and could be extended to other atmospheric issues as well.

The policies that could be adopted by the Government in respect of climate change and acid deposition include increase in power efficacy, power management and change of power blend is more towards renewables. These strategies are particularly required for reducing carbon dioxide emissions for which there is no abatement technology.

The problem of acidic deposition would also be reduced by use of low sulfur fuels, removal of sulfur from fuels, and the removal of sulfur dioxide and nitrogen oxides from the flue gases through add-on pollution control technologies.

In respect of acid deposition, it is also necessary to identify areas affected by acid deposition and areas susceptible to damage as soon as possible and undertake mitigatory measures.

In order to reinforce international efforts to deal with the problem of ozone layer depletion, the Government should promote the replacement of CFCs and other relevant compounds in the chemical industry through appropriate policy measures.

The Government should also ratify the Geneva Agreement on Extended-Range Transboundary Air Contamination and the Vienna Convention of the Protection of the Ozone Layer, expand practices for the control of relevant materials and analytically observe and state execution.

3.3 Situation in India

Despite a large network of meteorological stations and a few Backgrounds Air Pollution Monitoring Network (BAPMON) Stations of the Indian Meteorological Department, 30 National Air

Quality Monitoring Stations of NEERI and recently introduced monitoring stations of the Central and State Pollution Control Boards, there is no systematic data available in the country on the levels and variations of various greenhouse gases, ozone and the causative agent's ozone depletion, and acidic deposition.

Since the atmospheric phenomena are likely to have long-ranging meteorological, environmental and health impacts, appropriate monitoring and research activities need to be initiated in the country. Thrust should be given to

i. Establishment of network for monitoring greenhouse gases such as CO_2, CH_4, O_3, N_2O, $CFCl_3$ and $CFCl_2$
ii. Measurement of acidity and identification of areas affected by acidic deposition and areas susceptible to damage.
iii. Development of methods for estimating CO_2 in sea water and measurement of acidity.
iv. Study of CO_2 transport across atmosphere ocean interface.
v. Determination of dry deposition rates for acidic acrosois.
vi. Investigations into mechanisms and rate of catalytic oxidation of SO_2 and specification of relevant metals in the atmosphere.

CONCLUSIONS

With the galloping population pressures exerting ever-increasing demands for industrialization, urbanization, and fuller exploitation of natural resources, new environmental threats are emerging every day while existing ones are yet unsolved. Environment management, in such framework, demands an active strategy context in which the time delay among question growth, progress of technological solution, and corrective activity is reduced. This may involve information, institutional and policy measures that are substantially viable from those within the existing policy framework.

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