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Counterpart Arrangement

India NCPC and DTI International

Progress Report IV and

Final Report

Attachment to main report

December 1998

UNIDO Contract 95/295 Project EP/GLO/95/0C2

Attachment 1.

TOR

Assessment of the Impact of Project DESIRE on Uptake of Waste Minimisation in Indian Small Scale Industries

Assessment of the Impact of Project DESIRE on Uptake of Waste Minimisation in Indian Small Scale Industries

work proposal (final version: 17-07-97

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1. Background

Project DESIRE (DEmonstrations in Small Industries for Reducing wastE) was implemented in 1993 - 1995 on behalf of the Environment and Energy Branch of UNIDO in order to foster the implementation of Waste Minimisation in Indian Small Scale Industries (SSI). The project encompassed the development of a customised Waste Minimisation audit manual for Indian small scale industries, practical in plant demonstrations in 12 units in three industry sectors (agro-residue based pulp and paper, pesticides formulation and textile dyeing and printing industry), evaluation of barriers and incentives for Waste Minimisation and drafting of an overall enabling strategy for Waste Minimisation in India. The final report ([1]) was prepared on the basis of the state of affairs in December 1994. The project is known to have triggered the inception of various other projects for Waste Minimisation and/or Cleaner Production, in particular:

- establishment of the India National Cleaner Production Centre;
- creation of a nation wide network of Waste Minimisation Circles;
- launching of DESIRE-type demonstration projects in several neighbouring countries (including Nepal, Sri Lanka and Bangladesh);
- start of a regional Cleaner Production project in pulp and paper industry (in the framework of the NIEM initiative).

The initiators of project DESIRE (in particular UNIDO Environment and Energy Branch, India National Cleaner Production Centre and National Productivity Council) have shown a keen interest to assess the project achievements in detail. The proposed assessment is undertaken in order to generate insight in the long term impact of project DESIRE on the uptake of Waste Minimisation on Indian SSIs, as well as in order to draw lessons regarding the successful completion of Waste Minimisation demonstration projects, regarding the application of audit methodologies in Indian SSIs and regarding policies and strategies to promote Waste Minimisation in Indian SSIs. The proposed assessment is therefore based on an assessment of the impact of project DESIRE on the participating units, on comparable units in the same industry sector and/or region and on policies and strategies to promote Waste Minimisation/Cleaner Production in India. The following elaborates a work proposal for the execution of this assessment of project DESIRE. It encompasses objectives, work plan and a budget estimate.

[1] *From Waste to Profits, Towards Financial and Environmental Dividends from Waste Minimisation in Small Scale Industries in India, UNIDO Environment and Energy Branch, Vienna, 1995.*

2. Objectives and research strategy

Project DESIRE had five separate, but interrelated, objectives:

1. to show Indian SSIs in three sectors that Waste Minimisation is possible on the short term and that it has financial and environmental advantages;
2. to devise and test the usefulness of a customised systematic approach to Waste Minimisation;
3. to identify obstacles to the introduction and maintenance of Waste Minimisation options and to formulate strategies for overcoming them;
4. to recommend to various stakeholders, in both the Government and the industrial and professional community, policies that would promote Waste Minimisation;
5. to disseminate the results of the case studies and the policy recommendations.

The overall objective of the proposed assessment of the impact of project DESIRE is to assess the long term impact of project DESIRE on the participating demonstration units and on the industry sectors and regional business communities these demonstration units were part off, and to update the recommendations regarding methodologies, policies and strategies for the promotion of Waste Minimisation in Indian SSIs. The final report of this assessment, will address the following four overall - research - questions:

1. *What is the long term impact of project DESIRE on SSIs in India ?* This serves to document the financial and environmental benefits and impacts on technology and management systems in the participating units, as well as in comparable units in the industry sectors or business communities these demonstration companies were part of;
2. *What policy changes supportive of Waste Minimisation have been implemented and what have they achieved ?* The level to which various stakeholders have adopted the recommended policy changes is reviewed;
3. *How has the capacity developed as a result of the project been sustained, if at all, in the country ?.* Was the host institution sustained and/or other institutions created ? Have the national experts and others trained in the project continued to work in the field of Waste Minimisation ?;
4. *Which lessons can be learned from project DESIRE for future Waste Minimisation/Cleaner Production demonstration projects ?* i.e. which elements of project DESIRE contributed to its overall success and how can this insight in success factors in project DESIRE be translated into recommendations for future demonstration projects (both in India for industry specific demonstration projects as well as outside India for national demonstration projects).

In order to answer these research questions, the data collection will consist of:

1. *an assessment of the progress in the implementation and maintenance of Waste Minimisation in the participating units:* the evaluation scheme developed elsewhere for the quality of a Cleaner Production assessment ([2]) will be made operational for this assessment of the impact of project DESIRE on the participating demonstration units. This assessment will therefore address:
    - implementation status as well as the financial and environmental advantages of the Waste Minimisation solutions developed under project DESIRE;
    - new Waste Minimisation opportunities identified, evaluated and possibly implemented by the demonstration units after completion of project DESIRE;
    - structural changes made in the management and information systems, organisation structure and/or equipment operation and maintenance capabilities.

    This assessment will be based primarily on the results of on site visits and inspections of all participating units in two industry sectors (i.e. textile dyeing and printing and pulp and paper ([3])).. In order to further substantiate the environmental and financial benefits of Waste Minimisation, on site measurements (for 3 days) of energy, water and material consumption as well as of water and

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[2] *Berkel, R. van, Cleaner Production in Practice: methodology development for environmental improvement of industrial production and evaluation of practical experiences, University of Amsterdam, The Netherlands, 1996.*

[3] *The pesticides formulation sector is excluded from this assessment, since in the course of project DESIRE Waste Minimisation turned out to be the least attractive for this sector. Furthermore the Small Scale Industries in this sector are under great influence from a few large scale pesticides producers and formulators to adopt environmental and health and safety procedures. The dissemination of Waste Minimisation opportunities, and best environmental and operational practices in general, is in this sector therefore not considered representative for other industry sectors.*

air emissions will be conducted in four selected demonstration units ([4]). The current environmental loadings will be compared with the environmental baseline data collected at the start of project DESIRE in 1993 (after correction for changes in productive output, raw material selection etc.);

2. *assessment of the progress in the uptake of feasible waste minimisation solutions in other units, in the industry sector or business community the demonstration units were part of*: this assessment will be based on a description of the dissemination activities undertaken for the three industry sectors as well as in the industrial estates/regions in which the demonstration units were located. A survey will be undertaken among the known participants in the dissemination workshops under project DESIRE (and possibly also other activities) in order to assess management perceptions/attitudes regarding Waste Minimisation and environmental matters and to assess whether or not some 3 to 5 industry-specific 'typical/characteristic' Waste Minimisation solutions have been implemented. Furthermore, an attempt will be made to evaluate the impact of project DESIRE outside those directly affected by project DESIRE. To this end, industry and trade associations in the respective industry sectors will be contacted to find out whether or not Waste Minimisation initiatives have been taken elsewhere in the sectors;
3. *review of the progress in the implementation of policies and strategies that promote Waste Minimisation*: project DESIRE recommended to foster the uptake of Waste Minimisation in Small Scale Industries through three mechanisms (i.e. Waste Minimisation circles, mandatory Waste Minimisation audits, and demonstration projects). It will be reviewed whether or not governmental and non governmental agencies have adopted these, or other policy changes, and how effective these turned out to be so far.

3. Work plan and job division

The project work will be undertaken in three phases, respectively 'preparation', 'data collection & analysis' and 'synthesis & reporting'.

The first phase ('preparation') encompasses the preparation of formats for the data collection, tracking of the dissemination activities and their participants and identification of stakeholders. The formats for the data collection will be elaborated in checklists for the site visits to the demonstration units and questionnaires for the units which participated in the dissemination activities. Furthermore, for each sector a selection will be made of the few highly 'characteristic' Waste Minimisation opportunities (which will be used as an indicator for the uptake of Waste Minimisation outside the demonstration units).

The second phase ('data collection and analysis') encompasses the practical work (actual site visits to the demonstration units, description of the dissemination activities, review of policy changes, and evaluation of the uptake of characteristic Waste Minimisation options outside the demonstration units). This phase is to result in 'fact sheets' for each company, dissemination activity, etc. These fact sheets are the key findings of the evaluation study and serve as the basis for the final report.

The third phase ('synthesis and reporting') is based on the integration of the fact sheets produced so far in order to arrive at an overall assessment of the long term impact of project DESIRE and to arrive at 'lessons learned'. The result will be reported in a final report, which will be subjected to review by UNIDO.

The project will be conducted by a team of national experts assisted by an international Waste Minimisation/Cleaner Production expert. The national experts will be in charge of the assessment of the achievements at the demonstration unit, the evaluation of the dissemination activities and the review of policy initiatives. It is recommended to involve national experts who were also in some way involved in the execution of project DESIRE. The proposed job division is therefore:

- National Productivity Council (NPC): technical consultants in charge of on sire monitoring at selected demonstration units;

[4] *In pulp and paper and textile sectors, 2 units will be selected from the 4 demonstration units. The selected units are those units which are still operating under similar conditions (regarding use of raw material and fuel, final product, etc.) as during participation in project DESIRE.*

- Corporate Insight: HRD consultants in charge of the assessment of the impact of the dissemination workshops on the actual implementation of Waste Minimisation in other units (in the same industry sector or industrial groups the demonstration companies were part of);
- National Cleaner Production Centre (NCPC: created as 'off shoot' of project DESIRE): prime beneficiary of, and co-ordinator for, this proposed assessment and specifically in charge of assessing the implementation of Waste Minimisation options in the demonstration companies.

The international Waste Minimisation expert will assist in preparing the detailed questionnaires and formats for the different parts of the evaluation, and guide and supervise the collection of the data. Furthermore, he will be in charge of writing an overall report regarding this evaluation study. René van Berkel (lead international consultant during the implementation of project DESIRE) is willing to undertake this task.

The preliminary planning is given in the following figure. The planning will have to be fine-tuned, once this work proposal has been approved. The first mission is scheduled to take place sometime between September 16 and 26. The second mission will take place before the first Asian Pacific Roundtable on Cleaner Production (Bangkok, November 12-14) in order to be able to present some intermediate results of this assessment at this roundtable.

Phase	Month						
	8/97	9/97	10/97	11/97	12/97	1/98	2/98
1. Preparation	****	M**					
2. Data collection & analysis		**	****	M***	****	****	
3. Synthesis & reporting						**	****R

M = Mission
R = Report

The scope of work in each phase is elaborated below.

Phase 1: Preparation

Activity 1.1: Draft data collection formats and prepare draft questionnaires for demonstration companies and participants in dissemination workshops (international consultant)
Activity 1.2: Identify demonstration companies, participants in dissemination workshops, auditors and intermediary organisations (NCPC)
Activity 1.3: Start up mission, to finalise the data collection formats and to agree on how to report the collected data and trial evaluation for at least one demonstration company and a few other participants from the dissemination workshops (NCPC, Corporate Insight, UNIDO, international consultant)

Phase 2: Data Collection & Analysis

Activity 2.1: Evaluation at four companies in the first industry sector ([5]) (CNCPC), supported with on site monitoring at 2 selected units. (NPC)
Activity 2.2: Evaluation of the dissemination activities undertaken in the first industry sector (Corporate Insight)
Activity 2.3: Review of policy changes (NCPC, international consultant, UNIDO)
Activity 2.4: Review mission, to review the findings in the first industry sector and the intermediate findings regarding policies and trial evaluation for at least one demonstration company for the other industry sectors (Corporate Insight, NCPC, international consultant)
Activity 2.5: Evaluation at four companies in the second industry sector (NCPC), supported with on site monitoring at 2 selected units. (NPC);
Activity 2.6: Evaluation of the dissemination activities undertaken in the second industry sectors (Corporate Insight)

Phase 3: Synthesis & Reporting

Activity 3.1: Prepare final report on the project (international expert, with review by UNIDO, NCPC and other interested parties).

[5] *Given monsoon season, it might be most appropriate to take textile dyeing and printing as the first industry sector.*

In the course of the evaluation study the international expert will undertake 2 missions to India of each approximately 1 working week. Given the nature of the project, the international expert will only prepare a final report and not detailed reports of the missions undertaken.

4. Budget estimate

The workload is elaborated in the attached table. On the basis thereof, the budget is estimated to be:

international consultant	IVAM ([6])	29,120 U$	
	sub-total		29,120 U$
national consultants	NCPC ([7])	13,790 U$	
	NPC	14,180 U$	
	Corporate Insight	13,840 U$	
	sub-total		28,020 U$
grant total			57,230 U$

The total project costs will thus mount up to 57,230 US.

[6] *IVAM Environmental Research is willing to make René van Berkel available for this project at the reduced fee of 700 US/day (as in the NCPC programme)*

[7] *Included in the discretionary budget to NCPC.*

Assessment of the Impact of project DESIRE on uptake of WM in Indian SSIs (final version: 17-07-97)

Activities	international expert			NCPC			NPC			Corp. Insight		
	work. days	DSA days	int. trips	work. days	DSA days	nat. trips	work days	DSA days	nat. trips	work days	DSA days	nat. trips
1.1 Draft data collection formats	4											
1.2 Identify companies etc.				5								
1.3 Start up mission	7	7	1	7	5	1				7	5	1
2.1 Company evaluations 1 st sector				12	8	1	22	16	2			
2.2 Evaluation of dissemination 1 st sector										10	8	1
2.3 Revies of policie changes	2			4								
2.4 Review mission	6	7	1	6	5	1				6	5	1
2.5 Company evaluations 2nd sector				12	8	1	22	16	2			
2.6 Evaluation of dissemination 2nd sector										10	8	1
3 Final report	12			2						2		
4.0 Overall co-ordination	4			10								
Total units	35	14	2	58	26	4	44	32	4	35	26	4
Unit costs (U$)	700	165	1200	150	165	200	150	165	200	250	165	200
Lump sum analytical costs (U$)								1500				
Total costs (U$)	24500	2310	2400	8700	4290	800	6600	6780	800	8750	4290	800

Total budget (U$)		
international consultant		
IVAM		29210
national consultants		
NCPC		
NPC	14180	
Corporate Insight	13840	
total national consultants		28020
Grant total		**57230**

13790 discretionary budget NCPC

Attachment 2.

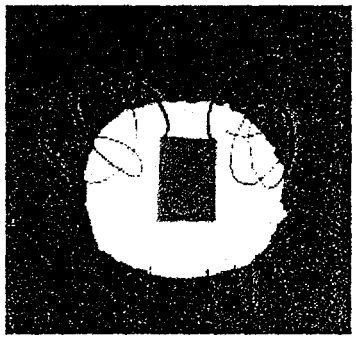
Final Report

Assessment of the Impact of Project DESIRE on Uptake of Waste Minimisation in Indian Small Scale Industries

Assessment of the Impact of project DESIRE on Uptake of Waste Minimisation in Indian Small Scale Industries

End Report

November 1998



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Aries Environmental Innovation
Nijmegen, Netherlands

Project assigned by
DTI International, Denmark

CONTENT

1. Introduction

Project DESIRE was implemented in 1993-1995 on behalf of the Environment and Energy Branch of UNIDO in order to foster the implementation of Waste Minimisation in Indian small scale industries (SSI's).
The project encompassed the development of a customised Waste Minimisation audit manual for Indian SSI's, practical in plant demonstrations in 12 units in three sectors, evaluation of barriers and incentives for Waste Minimisation, and drafting of an overall strategy for Waste Minimisation enabling in India.

The initiators of project DESIRE (UNIDO, India National Cleaner Production Centre (NCPC) and National productivity Council (NPC) have shown a keen interest to assess the project achievements in detail. The assessment described in this report was undertaken to generate insight in the long term impact of DESIRE in the uptake of Waste Minimisation in Indian SSI's, as well as to draw lessons from the successful implementation of Waste Minimisation demonstration projects, from the application of audit methodologies. Also, the developments regarding policy and strategy development were followed.

In order to find answer to these issues, the data collection was focused on the following three parts:
- Assessment of the progress in the implementation and maintenance of Waste Minimisation in the participating units in the DESIRE project
- Assessment of the progress in the uptake of feasible waste minimisation solutions in other units
- Reviews of the policy developments in Waste minimisation.

On behalf of UNIDO, this project was assigned by DTI International to Aries Environmental Innovation as international consultant. The work was performed by M. Crul as international Lead Consultant. In India, the project was performed by the team of the Indian NCPC, representatives of the Indian NPC, and consultants of Corporate Insight.

The basis of the assessment was the assessment questionnaire, as it is presented in Chapter 2, that was prepared Aries and IVAM Environmental Research (R. van Berkel).

The results of the assessment are presented in chapter 3 (progress in demonstration units) chapter 4 (progress outside demonstration unit) and chapter 5 (policy study).

2. Assessment Questionnaire

In this chapter, the final 1998 version of the assessment questionnaire, developed for the DESIRE Assessment is presented. The questionnaire was prepared by Aries together with Dr. René van Berkel, IVAM Environmental Research

The questionnaire consists of the following parts:

Part I: Progress in demonstration companies

I.1 Descriptive part
I.2 Quantitative part
I.3 Evaluative part

Part II: Progress outside demonstration units

II.1 Dissemination activities
II.2 Assessment actual implementation of Waste Minimisation
II.3 Analysis of dissemination as dynamic client-provider system

Part III: Review of policy implementation

III.1 Analysis of dissemination mechanisms related to existing policies
III.2 Level of adoption by stakeholders
III.3 Assessment of implementation level and effectiveness of Waste Minimisation mechanisms

Part I: Progress in demonstration companies

The assessment of the progress in the implementation and maintenance of Waste Minimisation in the participating units is divided in 3 parts, respectively:

1. *descriptive part*: summary of key features of the Waste Minimisation options implemented during, and in the wake of, project DESIRE, along with their economic and environmental benefits;
2. *quantitative part*: on site measurements of waste water discharges and energy and material consumption in order to compare the present environmental performance of selected companies with their environmental performance at the start of project DESIRE;
3. *evaluative part*: evaluation of the impact of participation in project DESIRE on the company's overall performance (rated as 'practical value') as well as the further development of its management and information system (rated as 'systemic impact') and the selection and management of its plant equipment (rated as 'technical impact').

Each is elaborated below.

I.1 Descriptive part

The descriptive part mainly consist of the compilation of the attached tables I and II. Table I covers all options identified as part of project DESIRE (and thus reported in the final report); the intention of this table is to map progress in the implementation of the options identified as part of project DESIRE, as well as the economic and environmental benefits thereby achieved. Table II deals with 'new' options; i.e. Waste Minimisation options identified, evaluated and - if proven feasible - even implemented after project DESIRE. The expected problem for the compilation of table II, is that most likely companies will only report those 'new' options which turned out to be feasible and could be implemented (i.e. tend to forget those options which they explored but could not implement). The national consultants should therefore try to identify as well the other options, which have been considered since DESIRE, but have not been implemented so far (due to lack of systematic approach, proven unfeasible, etc.).

The economic and environmental benefits are to be based on information provided by the companies; however this information is to be critically reviewed/verified by the consultants during the company visits. Information on benefits will only be collected for options implemented (during or in the wake of project DESIRE). In case environmental and/or economic benefits can not be allocated or subdivided to individual options, it might be considered to summarise benefits for groups of highly alike Waste Minimisation options (for instance: summation of benefits from all insulation measures, summation of benefits from all improved housekeeping options by process area/production department). The qualitative rating of the environmental impact of each option, is done on the basis of table III (refer table 2.6 PhD thesis René van Berkel). Since only the share of high and medium impact options really counts for the overall evaluation (part 3), this scheme may be applied with a certain degree of flexibility/expert judgement, especially for the comparatively large numbers of low and no cost options.

Primary environmental objective of the respective Waste Minimisation measure	Classification of Environmental Impact of Waste Minimisation Measure		
	low	Significant	large
1. Waste Minimisation	< 20 % reduction of the volume of the target waste stream/emission	between 20 and 50 % reduction of the volume of the target waste stream/emission	> 50 % reduction of the volume of the target waste stream/emission
2. Material and/or Energy Efficiency Improvement	< 10 % improvement of the efficiency of use of the target input	between 10 and 25 % improvement of the efficiency of use of the target input	> 25 % improvement of the efficiency of use of the target input
3. Substitution	Substitute has a longer	Substitute is a more envi-	substitute is much less haz-

	useful service lifetime (*)	ronmentally compatible (**)	ardous (***)

(*) in case the extended service lifetime can be quantified in terms of reduction of waste or emission generation, the substitution can be evaluated against the criteria for classification of 'Waste Minimisation'

(**) a substitute is considered more environmentally-compatible in case it is made of renewable or secondary materials, in case its biodegradability is higher and in case it has a significant lower impact on living nature.

(***) a substitute is considered 'much less hazardous' in case it eliminates one of the following substances: VOC's, CFC's, known toxic substances or heavy metals (listed for instance on USA TRI list).

Table III: Classification scheme for the environmental impact of prevention measures.

I.2 Quantitative part

The quantitative part is based on on-site measurements of water, energy and material consumption and waste water discharges at half of the participating demonstration companies. It is suggested to select those demonstration companies for the on site measurements which have not undergone major changes in their 'production niche' since the start of project DESIRE (i.e. are still producing essentially the same final product (or mix of final products), using the same (mix of) raw materials and the same type of production processes). It is suggested to summarise the results for each company in the formats stipulated in table IV (pulp and paper industry) and table V (textile dyeing and printing industry).

	Start of project DESIRE (April 1993)	Present situation (December 1997)	Improvement/ change (%)
Pulp mill (figures per ton of bleached pulp) • water consumption (ton/ton) • fibrous material consumption (kg/ton) • soda consumption (kg/ton) • steam consumption (ton/ton) • electricity consumption (kWh/ton) • waste water volume (ton/ton) • COD discharge (kg/ton) • TSS discharge (kg/ton)			
Paper Mill (figures per ton of finished paper) • water consumption (ton/ton) • auxiliaries consumption (fillers, etc.) (kg/ton) • steam consumption (ton/ton) • electricity consumption (kWh/ton) • waste water volume (ton/ton) • COD discharge (kg/ton) • TSS discharge (kg/ton)			
Pulp and Paper Mill (figures per ton of finished paper) • water consumption (ton/ton) • steam consumption (ton/ton) • waste water volume (ton/ton) • COD discharge (kg/ton) • TSS discharge (kg/ton)			

Table IV: Quantitative assessment for pulp and paper mills.

	Start of project DESIRE (August 1993)	Present situation (December 1997)	Improvement/ change (%)
Dyeing Section(figures per ton of bleached and dyed cloth) • water consumption (ton/ton) • dyestuff consumption (kg/ton) • hypochlorite consumption (kg/ton) • soda consumption (kg/ton) • steam consumption (ton/ton) • electricity consumption (kWh/ton) • waste water volume (ton/ton) • COD discharge (kg/ton)			
Printing Section (figures per ton of printed and finished cloth) • water consumption (ton/ton) • print paste consumption (kg/ton) • steam consumption (ton/ton) • electricity consumption (kWh/ton) • waste water volume (ton/ton) • COD discharge (kg/ton) • residual paste discharge (kg/ton)	(note: could also be done per m of printed cloth)		
Combined Dyeing and Printing Mill (figures per ton of finished cloth) • water consumption (ton/ton) • steam consumption (ton/ton) • waste water volume (ton/ton) • COD discharge (kg/ton)			

Table V: Quantitative assessment for textile dyeing and printing mills.

I.3 Evaluative part

It has been agreed to use the evaluation scheme proposed in 'Cleaner Production in Practice' as backbone for the evaluative part. The evaluation is therefore subdivided in:

- *practical value (short term indicator)*: this practical value is influenced by the implementation status of Waste Minimisation options, and the financial and environmental benefits gained with the implemented Waste Minimisation options. Three categories are used to rank the practical value ('low', 'significant' and 'large'). The rating is derived from the scheme given in table VI:
- *technical impact (long term indicator)*: the technical impact is preferably based on an appraisal of the waste cause features and the innovativeness of the technique for each of the implemented waste minimisation options. In order to simplify this part of the evaluation, it is proposed to count the numbers of respectively sector-specific typical 'environmental improvement' options and sector specific typical 'environmental innovation' options among all implemented Waste Minimisation options. Examples of such sector specific improvements/innovations are given in tables VII and VIII. The overall technical impact is rated as 'environmental innovation' (or 'large') in case of at least 3 environmental innovations, rated as 'environmental improvement' (or 'significant') in case the total number of environmental innovations and environmental improvements is larger then 5, and as 'environmental optimisation' (or 'low') in all other situations:
- *systemic impact* (long term indicator): the systematic impact reflects the contribution of the Waste Minimisation project to the implementation of management practices conducive to the continuation of Waste Minimisation. Nine environmental management practices were proposed. In order to simplify the assessment, it is suggested to concentrate on 5 environmental management practices, i.e. environmental policy/objectives, inclusion of environmental considerations in standard operating practices, employee involvement, materials accounting and Waste Minimisation assessments. The systemic impact is rated 'large' in case of implementation of at least 3 of these practices and rated as 'significant' in case of

implementation of at least 1 of these practices. The evaluation of the implementation status of the environmental management practices is based on the descriptions given in table IX.

The assessments regarding practical value, technical impact and systemic impact are integrated as an ABC ranking into a 3 digit Quality Index. The short term impact (i.e. practical value) is best measured at the end of project DESIRE (i.e. on the basis of the options listed in table I). The long term impact (i.e. technical and systemic) is best appraised on the basis of the present situation (on the basis of the Waste Minimisation options reported in table I and table II).

		Practical Value of the Cleaner Production Assessment		
Evaluation criteria	Parameter	low	significant	large
1. Implementation Status	share of implemented options in total number of prevention options	<10 %	Between 10 and 25 %	> 25 %
2. Economic impact	overall pay back period for all prevention measures	> 3 year	between 1 and 3 year	< 1 year
3. Environmental impact	Environmental impact of the prevention measures	at least one with significant environmental impact	At least three with significant or large environmental impact	at least one with large environmental impact and in total at least three with large or significant environmental impact

Note: The result should meet the requirements in all three categories (in other words: in case of different ratings on the three constituent criteria (i.e. implementation status, economic impact and environmental impact), the overall practical value will be rated as the lowest constituent rating.

Table VI: Classification scheme for 'practical value'.

	Environmental improvements	Environmental innovations
1. pulp mill	• optimisation of pulp cooking process (with/without additional measurement and control devices) • improvement of the raw material preparation (e.g. with modification of dry dedusting systems) • segregation and direct reuse of initial black liquor (with existing pulp washing system)	• installation of depither (for bagasse) • vacuum drum washers (for brown stock) • (double) screw press (for black liquor segregation) • (double) wire press (for black liquor segregation) elimination of hypochlorite for bleaching
2. paper mill	• installation of separate broke pulper • consistency control in pulp feed to head box	• high velocity hood on dryers • fibre recovery (save all) on white water
3. utilities/general	• installation of energy-efficient fans/pumps • recovery and reuse of steam condensate • application of better firing practices in boiler (including installation of basic instrumentation) • installation of economiser on boiler • rationalisation of steam and condensate pipes/distribution networks • power factor correction	• installation of energy efficient boiler

Table VII: Sector specific list of 'environmental improvements' and 'environmental innovations' for pulp and paper industry (non limitative: may be expanded on basis of on site observations in mills).

	Environmental improvements	Environmental innovations
1. dyeing section	• optimisation of bleaching and/or dyeing processes (with/without additional measurement and control devices) • dedicated dyeing equipment for large volume colours • direct reuse of cooling water as process bath make up water • collection/storage and direct reuse of spent dye bath (disperse dyeing)	• elimination of hypochlorite for bleaching • replacement of dyestuffs/auxiliaries by less hazardous substitutes • installation of low liquor (1: < 2.5) dyeing equipment
2. printing section	• installation of doctor blade for print paste recovery for printing blanket • improved production planning in order to minimise print paste remnants • counter current washing • systematic reuse of collected print paste remnants	• adoption of printing equipment with 'pigs' to recover residual print paste
3. utilities/general	• installation of energy-efficient fans/pumps • recovery and reuse of steam condensate • application of better firing practices in boiler (including installation of basic instrumentation) • installation of economiser on boiler • rationalisation of steam and condensate pipes/distribution networks • power factor correction • reduction of the number of colours in use (to maximum of 10) for each category of dyestuffs	• installation of energy efficient boiler

Table VIII: Sector specific list of 'environmental improvements' and 'environmental innovations' for textile dyeing and printing industry (non limitative: may be expanded on basis of on site observations in mills).

(Environmental) Management Practice	Indicators for significant progress in implementing respective (environmental) management practice
1. Environmental policy, strategy and/or objectives	• compliance with present environmental legislation • environmental considerations part of the medium term business strategy (regarding for instance the modification/upgrading of existing production facilities, introduction of new products, changes in processes, approaching new markets, etc.)
2. Production management	• standard operating practices established, implemented and updated on a

	periodical basis (e.g. annually)
3. Employee involvement	• some kind of training undertaken for operators/supervisors on importance of standard operating practices and/or costs of waste generation • participation of key staff members in periodic (e.g. quarterly) review of production records
4. Materials accounting	• monthly reviews of the efficiencies of utilisation of incoming materials and sources of non productive output • information system in place of material specific accounting of input materials and non productive outputs, on continual basis
5. Waste Minimisation Assessments	• Waste Minimisation included in the preparation of capacity expansion and/or renovation projects implemented since 1995 • new Waste Minimisation assessment undertaken since 1995

Table IX: Indicators for progress in implementation of environmental management practices conducive to uptake of Waste Minimisation.

Description of the Waste Minimisation Option	Implementation Status	Economic benefits (only for implemented options)		Environmental benefits (only for implemented options)		Remarks/comments
		Investment cost	net annual savings	quantitative	Qualitative	
This table should encompass all options listed in the final report of project DESIRE	1 = implemented during project DESIRE			e.g. energy saving. COD reduction etc.	Rating as 'low', 'medium' and 'high' impact options according to table III	
	2 = implemented since project DESIRE					
	3 = feasibility not yet proven					
	4 = proven (or considered) unfeasible					
Grant total: number of options	pie chart with division of options according to implementation categories 1, 2, 3 and 4.	Total Investment for all implemented options (I)	Total annual savings by all implemented options (S) Average pay back time: I/S	If possible: summation of environmental benefits; can be supplemented with information from on site measurements	pie chart with division of the implemented options as low, medium and high environmental impact	

Table I: Overview of the progress in implementation of the Waste Minimisation options developed as part of project DESIRE.

Description of the Waste Minimisation Option	Implementation Status	Economic benefits (only for implemented options)		Environmental benefits (only for implemented options)		Remarks/comments
		Investment cost	net annual savings	quantitative	Qualitative	
				e.g. energy saving. COD reduction etc.	Rating as 'low', 'medium' and 'high' impact options according to table III	
	2 = implemented since project DESIRE					
	3 = feasibility not yet proven					
	4 = proven (or considered) unfeasible					
	5 = considered, but not systematically evaluated (ant therefore not implemented)					
Grant total: number of new options	pie chart with division of 'new' options according to implementation categories 2, 3, 4 and 5.	Total Investment for all implemented 'new' options (I)	Total annual savings by all implemented 'new' options (S) Average pay back time: I/S	If possible: summation of environmental benefits; can be supplemented with information from on site measurements	pie chart with division of the implemented 'new' options as low, medium and high environmental impact	

Table II: Overview of the progress in implementation of the Waste Minimisation options generated after completion of project DESIRE.

Part II: WM Progress outside demonstration units

The assessment of Waste Minimisation uptake in companies outside the DESIRE demonstration units is divided into three parts, respectively:
1. *Descriptive assessment of WM dissemination activities*: the total effort of dissemination activities is described and analysed, both in the two industry sectors involved in DESIRE and in the regions/industrial estates in which the demonstration units were located.
2. *Waste Minimisation uptake in companies participating or contacted in WM dissemination activities*: the attitudes and perception regarding Waste Minimisation in companies involved in the dissemination activities are surveyed. Also, the current uptake of a number of generally feasible Waste Minimisation options in those companies is evaluated.
3. *Dynamics of the current dissemination system*: the differences of the uptake of Waste Minimisation are analysed on the basis of development stages in the dissemination system, for this purpose defined as a client/provider system.

II.1. Dissemination activities

As part of Objective five of the Desire project, three industry-specific workshops and a national seminar were organised to start the dissemination of the experiences of the project. The need for a properly planned dissemination strategy was stressed in the Desire final report. Next to the final report and general manual, sector-specific manuals were developed.
An important mechanism that was developed independently by NPC after DESIRE, but using the experiences and results of the demonstration project as input, was the establishment of waste minimisation circles in particular regions.
According to Chandak (1996), at the end of 1996 a total of 76 participants were counted in intensive training activities. 550 participants were counted in awareness programmes.
The influence of the Desire project on the other dissemination activities is not always obvious and explicitly (f.i. WMC). Therefore, a description of related issues going on in the targeted sectors has to be made, and the relation to DESIRE should hereby be assessed.
Last, a description is needed of the network that actually performed and performs the dissemination activities.

The following information is to be gathered (see Table X):

Activities undertaken

- What activities are undertaken (for each of the two sectors) in the dissemination process following project DESIRE
  - Training workshops
  - Waste Minimisation Circles
  - Publications
  - Information materials
  - Others
- What was, in brief, the content of each of the activities
- What were the objectives of the activities
- How was the target group selected
- What was the exact relation to DESIRE

Total number of companies contacted

- Participants in dissemination training workshops
- Informed industrial actors as in Waste Minimisation Circles

For those two groups: what was the estimated non-response percentage (targeted and approached, but not participating)?

- Other industrial actors - informed in other ways

❖ Estimated number of companies informed in other ways (reports, articles)

Other related activities undertaken in industry

What other related activities were undertaken in the same sector that has a clear relation to the Waste Minimisation approach. This can be:

❖ information/implementation of ISO 14000 or
❖ other Environmental Management systems
❖ UNCED-related activities that stress Waste minimisation approaches in industry
❖ ISO 9000 and related quality programmes.

Network Description

What were the specific activities and the role of the following network actors in the dissemination programme:

❖ NCPC
❖ NPC
❖ Industry associations (national and regional)
❖ Consultants
❖ Universities
❖ Technical institutes
❖ Government (divide as necessary)
❖ Environmental Agencies
❖ Others:..

Table X: Descriptive questionnaire on dissemination activities

II.2. Assessment actual implementation of Waste Minimisation

On the basis of the descriptive data of part II.1, an assessment is made of the progress in uptake of the perception of company management and change in attitude and behaviour towards Waste Minimisation, and of the actual implementation of Waste Minimisation solutions in other companies then the DESIRE demonstration units.

a. Survey on perception, attitude and behaviour

To assess the influence of Desire on the perception, attitude and behaviour towards Waste Minimisation in non-demonstration companies, a brief survey will be taken among a selection of companies that have been involved in any way in the dissemination activities following DESIRE.
The target group for this survey can be divided into three segments: WMC participants, dissemination workshop participants and other firms in the same region as the demo-units. All companies in those segments are only chosen form the designated industry sectors (P&P and textile).

- WMC participants: Since successful circles have actually implemented many of the WM measures, they will score high on the survey and implementation (parts II.2.a and II.2.b). Most interesting part for this group will be the dynamics evaluation in II.3.
- Dissemination workshop companies: Variance will be bigger, also in attitude/behaviour survey.
- Other companies in the region; highest variance.

The following questions will be asked (table XI).

• Did you value the information on Waste Minimisation that you received? • Did this improve your awareness on Waste Minimisation? • Was the information potentially useful for your company?	If 2 or 3 'yes': Positive effect on awareness on Waste Minimisation
• Did you see possibilities for Waste Minimisation in your company afterwards? • Did your vision on materials use, wastes and emissions, processes in your company changed because of the information?	If 1 or 2 'yes': Positive effect on attitude towards Waste Minimisation
• Did you actually undertake actions to start a Waste Minimisation approach? • Did you actually implement one or more Waste Minimisation measures (see below for list)? • Did you continue with new Waste Minimisation activities after the first results?	If first 'yes': small change in behaviour If 'yes' also to second: considerable change If 3 'yes': big change in behaviour.

Table XI: Company survey on Perception, Attitude and Behaviour

On the basis of this survey, it can be estimated what part of the companies that have been included in direct WM dissemination activities actually changed their awareness, attitude and behaviour towards Waste Minimisation. Also, differences between the workshop and Waste Minimisation circle companies can be estimated.

b. Implementation of generally feasible Waste Minimisation options

Unavoidable, to a certain extent, the results of the survey described above will be subjective, since they mainly reflect the opinion of the managers of their own attitude and behaviour. Therefore, also a more objective survey on the actual implementation of a number of Waste Minimisation options will be performed.
It was agreed to base the assessment of the uptake of Waste Minimisation in other companies in the same sector at least partially on the level to which more or less generally feasible Waste Minimisation options have been implemented. The following tables XII and XIII provide lists of such generally feasible options for respectively pulp and paper and textile dyeing and printing industries. The options are grouped in five categories; each category encompasses highly alike Waste Minimisation options. One might view the options in the same categories as different ways of implementing the same Waste Minimisation approach, each customised to specific circumstances in different units in the same industry sector. It is recommended to assume that in case a company has implemented options from at least 3 of the five categories the company has undertaken a deliberate effort to implement Waste Minimisation
Since this part of the research will be performed by Corporate Insight, who are not technically qualified to validate the statemenst on this by the companies, it is proposed that CI asks open question on options implemented by th ecompanies, and only list them. NCPV will categorize these answers later according to (adjusted) tables XII and XIII.

Category/Waste Minimisation Approach	Examples of generally feasible Waste Minimisation options in respective category
1. insulation of hot process equipment, steam and condensate pipes, etc.	• insulation of steam pipes and traps, and condensate pipes and tanks • insulation of digestors • insulation of drum ends in paper machine drying section

2. proper raw material preparation	• improved incoming material control in order to avoid excessive levels of chaff, leaves, dust, or moisture • improvement of the (dry) dedusting system (for straw) • improvement of the raw material cutting system (for bagasse, elephant grass, etc.) • installation of depither (for bagasse)
3. segregation of initial black liquor	• modified operating practices for pouch washer in order segregate some black liquor for direct reuse prior to adding washing water • installation of improved black liquor segregation/pulp washing systems (screw press, wire press, etc.)
4. water conservation	• self closing valves on water taps • repair of leaks • water efficient nozzles for belt washing on paper machines • white water recovery and reuse
5. fibre recovery	• avoidance of overflows in wire/couch pit • optimisation of side cutting on paper machine • installation of fibre recovery system for white water

Table XII: Generally applicable Waste Minimisation options for pulp and paper industry.

Category/Waste Minimisation Approach	Examples of generally feasible Waste Minimisation options in respective category
1. insulation of hot process equipment, steam and condensate pipes, etc.	• insulation of steam pipes and traps, and condensate pipes and tanks • insulation of (jet) dyeing equipment, stenters and drying ends of printing machines
2. reuse of spent process baths	• storage and direct reuse of spent dyeing baths (disperse dyeing)
3. standardisation of dyeing/printing recipes and minimisation of colour stock	• reduction of the number of colours in stock for each class of dyestuffs (preferably to less than 10) • standardisation of the preparation of dyeing recipes and shade matching (including maintenance of database of dyeing recipes) • experimentation with the reduction of auxiliaries (salts, levellers, etc.) in dyeing recipes
4. water conservation	• self closing valves on water taps • repair of leaks • reuse of cooling water as process water • counter current use of washing water • installation of low liquor (jet) dyeing equipment
5. print paste recovery and reuse	• installation of doctor blade for recovery of residual print past from printing machine • improved production planning in order to minimise print paste remnants at the end of printing jobs • use of proper utensils to empty screens and other parts of printing equipment, prior to equipment cleaning at change of design/colours

Table XIII: Generally applicable Waste Minimisation options for textile dyeing and printing industry.

II.3. Analysis of dissemination as dynamic client-provider system

The dissemination programme for Waste Minimisation that followed the Desire project is relatively recently started. It can therefore be expected that the phases differ in which the dissemination efforts with different companies are taking place: some contacts are new, others more mature. If this is not taken into account in the assessment given above, the results could seem more negative then they really are.
The results measured at this particular moment must therefore be set in the context of the dynamic development from the start of the dissemination effort, until the continued involvement of a company with Waste Minimisation. Analysing the dissemination efforts as a client-provider system can best do this. The companies are the client, the network (described above in II.1) delivering the Waste Minimisation information and expertise are the suppliers. In this system, the suppliers will have the objective to first create interest in Waste Minimisation and the approaches and 'products' offered by them. This interest should turn into actual first use of Waste Minimisation approaches and 'purchase' of the products offered. Ultimate goal is, that the Waste Minimisation approach is integrated in the company, and contacts with the suppliers are frequent and interactive.

So, in such a relation, four stages can be postulated:
- Ignorance of the company towards Waste Minimisation
- Interest in the approach
- Initiation of the first activities
- Complete involvement/integration of the approach in the companies' activities

Clearly, this process can take some time to develop. Therefore, it has to be assessed what part of the companies is in what stage of the relation: for each of the company categories an estimate is made of the division between the different stages (10-20-30% etc.) (Table XIV)

Stage Category:	Ignorance	Interest	Initiation	Involvement/ Integration
Workshop participants	..%			
Waste Minimisation circle participants				
Other companies in region				
Not informed companies (rough estimate)				

Table XIV: Relative division over Relationship stages within company categories

On the basis of this assessment, a better picture can be obtained on the actual stage that most of the companies are in, and can supply some amendments to the results of the evaluation in II.2 .

A second aspect of the dynamic approach is that to push forward the number of companies to the later stages, different tactics have to be applied at each stage. To be able to develop further the interactive approach needed for this, a brief survey should be undertaken within a selected group of the companies that are known to be in a certain phase, and following questions are to be asked:
- What benefits do you perceive for your company if applying Waste Minimisation?
- What information/services do you require for your next steps in the Waste Minimisation approach?
- What do your think are the strongest points of the Waste Minimisation approach?
- What do you think are the main weaknesses from the Waste Minimisation approach?
- What requirements do you need from the supplier of Waste Minimisation info and services?

The results of the survey can be summarised in the table XV below

Variables for consideration:	Companies at stage:	Description
Benefits perceived	Interest	
	Initiation	
	Integration	
Range Info/Services offered/accepted	Interest	
	Initation	
	Integration	
Perceived Strength/weaknesses of Waste Minimisation	Interest	
	Initiation	
	Integration	
Desired Relationship	Interest	
	Initiation	
	Integration	

Table XV: Description of variables for consideration on improved Waste Minimisation uptake

Part III. Review of WM policy implementation

The review of the progress of policy implementation is divided into three parts, respectively:

1. *Analysis of the three selected Waste Minimisation implementation mechanisms in relation to existing policy*: Project Desire recommended to foster Waste Minimisation uptake by means of three mechanisms: Waste Minimisation Circles, mandatory Waste Minimisation Audits and demonstration projects. Each of these mechanisms will be analysed against the background of the necessary existing policy
2. *Level of adoption of mechanisms by network actors*: For the mechanisms stated above and some others, it will be reviewed whether and to what degree the network actors involved (see II) have adopted them.
3. *Assessment of implementation level and effectiveness of the three mechanisms:* The actual effectiveness so far of the selected three mechanisms will be estimated.

Again, due to the relatively short period of policy development and implementation, it is proposed to model the review in such a way, that both the current status of implementation and the expected/desired developments can be assessed.

III.1. Analysis of dissemination mechanisms related to existing policies

On the basis of the analysis of external enabling measures needed for Waste Minimisation dissemination, the project Desire proposed three implementation mechanisms through which the network of stakeholders could improve the uptake of Waste Minimisation. The mechanisms are:

1. *Waste minimisation Circles:* area-wide groups of industries co-operating on a voluntary basis with a view to exchange information on (mainly low- and no-cost) Waste Minimisation opportunities for solving common environmental problems.
2. *Obligatory waste minimisation audits:* The inclusion of the requirement to submit a Waste Minimisation audit as part of the application within financial and fiscal schemes foe SSI's, and in funds and soft loans for investments in pollution control systems.
3. *Waste Minimisation demonstration projects:* These consist of technical assistance and methodological guidance to a limited number of selected industries (regional and/or sectoral), followed by widespread dissemination of results and training activities.

To make these mechanisms successful, a number of push & pull starting conditions have been formulated:

Creating the demand:	-	Information exchange and awareness raising
	-	Enforcement and improvement of environmental legislation
	-	Development of financial incentives
Creating the supply:	-	Capacity building
	-	Establishment of technology co-operation
	-	Training policies

To assess the overall applicability of the implementation mechanisms, the following review of current existing policies has to be carried out. In all relevant policy areas, the current existence of the enabling starting conditions should be formulated as shown in Table XVI below.
Note: Of course not all cells of the table have to be filled. Some policy areas have more relevance to the starting condition then others. A first assumption of the relative importance is given.

A brief formulation of the existing policy is sufficient for the first analysis.

Policy area / Starting condition	Financial/ Industrial policy	Environmental Policy	Ethnology & Science policy	Education & Training policy
Information exchange		*	**	*
Environmental legislation	*	**		
Financial incentives	**	**	*	
Capacity building	*	*	*	**
Technology co-operation			**	
Training policies	*	*		**

Table XVI: Review of current existing policy elements that encourage Waste Minimisation uptake mechanisms
*) expected to contain relevant element(s), **) expected to be important

On the basis of this analysis, it is possible to perform a 'white spot' analysis: an assessment of the necessary policy elements lacking at this time. To complete this analysis, it may be necessary to take into account the policy developments that can be expected to take place in the future.

III.2. Level of adoption by stakeholders

To deploy the use of the three implementation mechanisms, the Desire project formulated a number of key stakeholders that should play a role in this:

- NCPC
- NPC
- Industry associations (national and regional)
- Consultants
- Universities
- Technical institutes
- Government
- Environmental Agencies

It should therefore be assessed, what the actual uptake of the mechanisms by the stakeholders currently is, what activities have been undertaken, and what other activities are undertaken by those stakeholders.

Activities / Stakeholder	WM Circle	Audit	Demo Projects	Capacity Building	Awareness Programs	Other
NCPC						
Industry associations						
Consultants						
Universities						
Technical institutes						
Government (divided into dept.)						
Environmental Agencies						

Table XVII: Actual uptake, activities and result of dissemination mechanisms

This analysis again is the basis for a "white spot" analysis: What activities by which stakeholders have not been performed that are nonetheless essential for the successful implementation of Waste Minimisation?

III.3. Assessment of implementation level and effectiveness of Waste Minimisation implementation mechanisms

The final purpose of the Waste Minimisation dissemination mechanisms is to create an ongoing process of implementation of Waste Minimisation in Indian SSI's.
The essential criterium to evaluate the mechanisms is whether they were effective in reaching this target.
In general, the effectiveness of the mechanism expresses to what degree the mechanism has contributed to reaching the stated goals. The goals for each of the mechanisms have been formulated in Desire as follows:

Waste Minimisation circles:

- Increasing number of companies in regions start with Waste Minimisation
- Dissemination and implementation of low-no cost options takes place
- Co-operation between companies for environment-driven technology takes place

Obligatory Waste Minimisation Audits:

- Strong drive for implementation of Waste Minimisation options
- Preferential allocation of finances for Waste Minimisation as compared to end-of-pipe

Waste Minimisation demonstration projects

- Convincing company-level examples of Waste Minimisation

- Inventory of practical Waste Minimisation opportunities for dissemination
- Training of experts and capacity building

Since all of these targets are formulated in a qualitative way, it is proposed to evaluate the effectiveness of each of them on a scale of three: High, significant or low effectiveness. The overall rating of effectiveness of the mechanism will be the lowest constituent rating. The rating is given in table XVIII.

Effectiveness Mechanism/criteria	Low	Significant	High
Effectiveness of Waste Minimisation circles			
• Increasing number of companies in regions start with Waste Minimisation	No increase	Significant increase	Great increase
• Dissemination and implementation of low-no cost options takes place	No or almost no implementation	Reasonable or high dissemination, reasonable implementation	High dissemination, high implementation
• Co- operation between companies for environment-driven technology takes place	No co-operation and technology development	Some co-operation and development	Frequent co-operation and development
Effectiveness of Obligatory Waste Minimisation Audits:			
• Strong drive for implementation of Waste Minimisation options	No/almost no options implemented	Some/reasonable number of options implemented	Large number of options implemented
• Preferential allocation of finances for Waste Minimisation as compared to end-of-pipe	Low allocation	Significant allocation	Large allocation
Effectiveness of Waste Minimisation Demonstration projects			
• Convincing company-level examples of Waste Minimisation	No/few	Some/reasonable	Many
• Inventory of practical Waste Minimisation opportunities for dissemination	Small inventory	Reasonable inventory	Large inventory
• Training of experts and capacity building	No training, little capacity	Reasonable number of training activities, reasonable capacity	Large number of training activities, large capacity

Table XVIII: Effectiveness of implementation mechanisms

3.1

PROJECT DESIRE

Post Project Evaluation

SECTOR - Pulp & Paper

UNIT - Bindla's Duplex

During the project period i.e. till Dec'94, a total of 51 Waste Mnimisation (WM) were identified of which 16 options were rejected due to their low financial and/or technical feasibility as given in detailed worksheets.

Out of the remaining 35, upon completion of the Project i.e. Dec'94, 18 were already implemented, 10 were under implementation and 7 were yet to be implemented.

The situation changed in the post project period. Of the 18 options which were implemented, 16 continued to be implemented and 2 were discontinued due to operational/technical problems. Out of the 10 options which were under implementation, 7 were implemented and 3 could not be implemented due to technical reasons.

The best part was that the unit WM team identified and implemented a fresh set of 9 WM options (which were recorded) resulting into significant economical & environmental benefits. Out of 9 new options, one option has been commercialised by the unit and selling to other similar units. Out of 9 new implemented options, one was discontinued due to operational problems and needs further modification.

The total number of options which were implemented and continue to be implemented are 31.

The unit has so far made a total capital investment of Rs.23.56 million. The annual savings amounts to Rs.28.22 million.

On the environmental front, data collection/monitoring is in progress and actual impact will be known after NPC study report. However, water consumption has reduced from 240m^3/Ton of paper before DESIRE to <100m^3/Ton in Dec'97.

The unit has gone for expansion and at present unit is producing 70 ton of paper/day compared to 30 Ton before.

Status of Implementation in Dec'97

Continue to be implemented	-	16
Earlier identified option implemented	-	7
Earlier identified option not implemented	-	10
Impl. Option discontinued options rejected	-	2
Options rejected	-	16
		51
New option identified	-	9
New option discontinued	-	1
Total option implemented - 23+8	=	31
Option not implemented	-	10
Option recycled	-	19
		60

Financial Analysis for WM options implemented by Dec'94

Option No.	Investment INR	Saving INR
1	20,00,000	18,00,000
2	4,00,000	26,00,000
3	2,50,000	3,00,000
4.	6,00,000	4,50,000
5.	50,000	-
7.	2,00,000	-
8.	5,00,000	6,00,000
20.	1,00,000	1,50,000
26.	30,000	54,000
28.	Nil	-
29	60,000	-
36	50,000	1,00,000
37.	50,000	66,000
40.	Nil	2,20,000
46.	1,50,000	96,000
	44,40,000	64,36,000

Financial Analysis of new WM options implemented by Dec'97
(After the project period)

Option No.	Investment (In Rupees)	Saving (In Rupees)
1	23,000	4,00,000
2.	25,000	7,20,000
3.	42,000	68,000
5.	Nil	2,00,000
6.	1,80,00,000	2,00,00,000
7.	7,00,000	Nil
8.	30,000	4,00,000
9.	3,00,000	No.
	1,91,20,000	2,17,88,000

NOTE: Option No.5 has not only been implemented but commercialised. Unit has started manufacturing and marketing of energy efficient refiner discs for agro residue raw material.

BINDLA'S DUPLEX (MUZAFFARNAGAR)

Description of the Waste Minimisation Option	Implementation status as on Dec'94	Economic benefits (only for implemented options)		Environmental benefits (only for implemented options)		Implementation status as on Dec'97	Remarks/ Comments
		Investment Cost	Net annual savings	Quantitative	Qualitative		
1. Installation of high velocity hood on steam dryer.	Imp.	2.0 Million Rupees	1.8 M/ year		Due to steam cons. Red. marginal red. in air emission from boiler house	CI	Due to increase in production capacity economically attractive
2. Optimisation of Pulp cooking process	Imp.	0.4 Million Rupees	2.6 M. Rupees	10% red. in total poll. Load	-	CI	
3. Fibre saver installation in centri cleaner	Imp.	0.25 Million Rupees	0.3 M Rupees	2.1% red. in TSS & COD load	-	CI	Cleaning of CC drain became easlier
4. Installation of additional press set	Imp.	0.6 Million Rupees	0.45 M Rupees		Marginal red. in air emissions	CI	Due to red. in paper breakage frequency production increased marginally
5. Substitution of fresh Water (Max. possible) with back water	Imp.	50,000 Rupees	NQ	Red. in eff. vol. by 20%		CI	Enabled mill to operate during dry season (water storage)
6. Installation of straw cleaning (vibration screen)	To be imp.	-	-		Red. in TS, COD load	NI	Additional benefits are improved with part drainability, reduced CC loading
7. Installation of screw press for pulp dewatering	Partly Imp.	0.25 Million Rupees	0.3 M Rupees	Red. poll. Load by 30%	-	Discontinued.	Measure has been suspended due to technical problem in press and needs modification

8.	Installation of bagasse depither	Imp.	056 Million Rupees	0.6 M Rupees	Red. in TS by 20% & COD by 22%		CI	Reduced chemical steam cons. And better runability of paper machine
9.	Eliminate use of top portion of elephant grass (25% leaves)	Rej.	-	-	-	-	Rej.	Due to high moisture content, no technical feasible option could be evolved
10.	Raw material impregnation with recycled black liquor	UI	30,000 Rupees	90,000	NQ	-	Imp.	
11.	Raw material impregnation with caustic soda	Rej.	-	-	-	-	Rej.	Due to high investmen not considered to be attractive
12.	Multiple loading of digester	Imp.	Nil	NQ	NQ	-	CI	Increased time due to multiple loading, offse benefits of extra loadi batch
13.	Usage of anthraguinone (AO) catalyst as cooking aid	Rej.	-	-	-	-	Rej.	Probable increase in % yield & pulp quality at additional chemical cost was not attractive
14.	High yield mechano-chemical pulping	Rej.	-	-	-	-	Rej.	Not considered due to higher investment & additional requirement for steam & electrical energy
15.	Installation of twin-wire belt press for pulp dewatering	Rej.	-	-	-	-	Rej.	Due to non-availabilit equipment indigenously and requirement of additional balancing equipments
16.	Installation of vacuum filter washer for pulp washing	Rej.	-	-	-	-	Rej.	Major investments in terms of equipment, building is required hence not considered for implementation

17. Hot stock refining	UI	1,50,000 Rupees	286,000 Rupees	Insigni-ficant	-	Imp.	Reduced electrical cons. & screening rejects
18. Conversion of lignin to ligno-sulphonate	Rej.	-	-	-	-	Rej.	Very expensive measure & techno-economically not proven so far proven so far.
19. Provision of hot water for digestors recovered from DG set waste heat	Rej.	-	-	-	-	Rej.	DG set operates only during power failure, therefore regular availability of hot water was not ascertained
20. Insulation of digestor	Imp.	100,000 Rupees	150,000 Rupees	Nil	-	CI	Due to BL spillages & rotation sagging of insulation was observed
21. Substitute Alum with poly aluminium silicate-sulphate (PASS) as sizing chemical	UI	-	-	-	-	NI	
22. Install consistency indicator	To be imp.	-	-	-	-	NI	Reduces human error & less paper breakage
23. Use of dye fixing agents SARSOLAN & TAMOL NVOX	Imp.	Nil	NQ		Reduced Toxicity of effluents.	CI	
24. Proper position of guards to prevent pulp spillage from DM head box	UI	-	-	-	-	NI	
25. Arrangement for fine-tuned dilution contract at fan pump	To be imp.	-	-	-	-	NI	
26. Controlled water pressure for edge cutting nozzles	Imp.	30,000 Rupees	54,000 Rupees		Marginal red. in SS	CI	Easily implementable. Reduces paper breakage due to variation in nozzle pressure
27. Double-felting to reduce press picking	UI	NQ	NQ	-	-	NI	
28. Avoid fan pump pit over flow by providing level control in fan pump pit	Imp.	Very little	NQ		Red. TS & COD load	NI	Easy implementation and maintenance

29. Install riffler to remove sand from CC waste	Imp.	60,000 Rupees	NQ			Dis-continued	Choking of drain avoi d and recovery of coarse fibre for straw board
30. Installation of high pressure fan flat nozzles in cleaning showers	To be imp.			-	-	NI	
31. Adjustment of paper width by edge cutting device	Rej.					Rej.	Paper width is governed by market demand
32. Installation of broke pulper in paper machine	Rej.					Rej.	Space requirement wa the bottleneck
33. Installation of Auto moisture controller	Rej.	-	-	-	-	Rej.	Major retrofit & expensive option
34. Proper surface preparation/timely replacement of upper press roll to reduce press picking	Imp.					CI	Adopted as a routine maintenance program e of the unit in 1995
35. Installation of on-line quality control system	Rej.	-	-	-	-	Rej.	
36. Insulation of feed water tank and condensate recovery tank	Imp.	50,000 Rupees	100,000 Rupees		Marginal red. in air pollution	CI	Easily implementable
37. Rationalisation of steam supply line	Imp.	50,000 Rupees	66,000 Rupees		Marginal red. in air pollution	CI	To avoid unnecessary bends and submerger e of condensate lime in water
38. Waste heat recovery from DG set	Rej.	-	-	-	-	Rej.	
39. Provision of fuel feed controller mechanism in boiler	Rej.					Rej.	Found techno-economically not feasible for the capac of boiler
40. Combustion optmisation in boiler	Imp.	Nil	2,20,000 Rupees		Red. air pollution	CI	The measure require improvement in operational practices

41. Microprocessor based excess air controller for boiler	Rej.	-	-	-	-	Rej.	Economically not viable
42. Covering of all vibratory screw and chemical dosing tanks	UI	15,000 Rupees	NQ	-	Better stop floor environment	Imp.	
43. Replace water seal with mechanical seal	To be imp.	-	-	-	-	NI	
44. Provision of hot water in digestor	UI	NQ	NQ	NQ	-	Imp.	
45. Replace GLS with CFL	Rej.	NQ	NQ	NQ	-	Rej.	Due to high investment costs, was rejected
46. Installation of CVT at PMC drive	Imp.	150,000 Rupees	96,000 Rupees	-	-	CI	
47. Provision of dyke in rag pulp dumping area	UI	2,000 Rupees	Nil	-	Proper collection & disposal of black liquor	Imp.	This measure pertains to housekeeping
48. Installation of spring actuated closing valves in all water hose pipes	To be imp.	NQ	NQ		Reduced water cons. & waste water generation	NI	
49. Repair of raw material conveyor	To be imp.					UI	Reduced losses of Raw Material as well as contamination of cooked pulp with Raw Material
50. Adjust slope of beaters to reduce beating time	UI	10,000 Rupees	24,000 Rupees	-	Reduced elec. energy cons.	Imp.	
51. Avoidance of pump gland leakage	UI	-	-	-	-	Imp.	

LEGEND:

NI - Not Implemented
Imp. - Implemented
CI - Continues to be Implemented
UI - Under Implementation
REJ. - Rejected
NQ - Not Quantified

BINDLA'S DUPLEX - NEW OPTIONS

Description of the Waste Minimisation Option	Economic benefits (only for implemented options)		Environmental benefits		Implementation status as on Dec'97	Remarks/ Comments
	Investment Cost	Net annual savings	Quantitative	Qualitative		
1. Installation of Rosin Dosing Pump to replace manual Dosing	23,000	4,00,000	NQ	Reduced organic load	Imp.	
2. Installation of Alum dosing pump to replace manual dosing	25,000	7,20,000	NQ	-	Imp.	
3. Installation of hill screen on decker to increase pulp consistency	42,000	68,000	Nil	Nil	Imp.	Reduced elect. cons.
4. Pulp washing consistency at potcher was increased	Nil	NQ	NQ	NQ	Imp.	Reduced refining energy
5. Replacement of refiner disc suited for weak fiber	Nil	NQ	NQ	NQ	Imp.	Red. energy for refining
6. Installation of Additional self electrical generation capacity of 4580 KVA		18.0 M	20 M	NQ	Imp.	Due to cont. supply, 2 pump storage chest have been bypassed
7. Installation of crusher to squeeze black liquor from rag pulp		0.7 M	Nil	NQ	Discontinued	Imp. but discontinued due to operational problem
8. Installation of 2 sedimentation savealls		30,000	4,00,000	Reduced TSS & org.poll load		
9. Modification in vacuum system to improve mechanical dew		3,00,000	NQ	NQ	Imp.	-

Waste Minimisation Progress Assessment
At
M/S Bindlas Duplex Paper Mill, Muzaffarnagar

Detailed monitoring studies were under taken by NPC to asses the resource consumption and waste water generation pattern at M/s Bindlas Duplex Pvt. Limited, Muzaffar Nagar during 22nd Sept to 24th Sept'98. The unit has enhanced its production capacity and is at present producing 30 Tons (monthly average) of craft paper per day as against the 26 T/d in Apr'93. The fibrous raw materials for the paper production keep changing depending on the availability. During the time of monitoring the unit was using 36 T of agro residue (mainly elephant grass) and 15 T of waste paper. The monitoring details are given below:

Pulp Mill

Pulp mill has 4 Process waste stream namely Potcher washing, Beater washing, Pulp mill centricleaner and Back water over flow. However during the monitoring it was observed that Beater washing has been stopped as at present the unit is not using Hessian as raw material. Remaining 3 waste streams were subjected to 24 hrs continuous monitoring. The monitoring results for the pulp mill are indicated in the table below:
Date: 22.09.98

Waste Stream	**Flow (m^3/d)**	**COD (mg/l)**	**COD Load (Kg/d)**	**TSS (mg/l)**	**TSS Load (Kg/d)**
Potcher washing	1321	12833	16952	6035	7972
Beater washing		Discontinued			
Pulp mill Centricleaner	96	653	63	5740	551
Back Water	600	2850	1710	1572	943
Total	*2017*	*1284*	*18725*		*8466*

The consumption pattern for major resources in the pulp mill was also worked out based on the monthly consumption figures. The average per day consumption for the various resources used in pulp mill are given in the following table

Pulp Mill : Resources daily consumption (Average)

S.No.	Resource	Consumption /d
1	Fresh water	2430 m^3
2	Caustic Flakes	2540 Kg
3	Steam	60 T
4	Electricity	9000 KWH

The production specific resources consumption and pollution load generation quantities for the pulp mill are summarised in the table below

S.No.	Particulars	Quantity/d	Quantity/T of paper
1	Fibrous Material Consumption (T)	51	1.7
2	Fresh Water Consumption (m^3)	2430	81.0
3	Caustic Flakes Consumption (Kg)	2540	84.7
4	Steam Consumption (T)	60	2.0
5	Electricity Consumption (KWH)	9000	300
6	Waste Water Generation (m^3)	2017	67.23
7	COD Load Generation (Kg)	18725	624.2
8	TSS Load generation (Kg)	8466	282.2

Paper Mill

Paper mill has 3 process waste streams namely Centricleaner discharge, Fan pump pit overflow and Paper machine drain. However since the unit at present is manufacturing the low grade paper with lower bursting factor, the unit is not using the centricleaners and are being bypassed. Hence at present the waste water in the paper mill is generating only from fan pump it overflow (including vacuum seal water) and paper m/c. Both of these stream were monitored continuously for 24 hrs. The waste water monitoring of analysis results are given below:

Date: 23.09.98

Waste Stream	**Flow (m3/d)**	**COD (mg/l)**	**COD Load (Kg/d)**	**TSS (mg/l)**	**TSS Load (Kg/d)**
Centricleaner Discharge	Discontinued				
Fan pump pit overflow (along with Vacuum seal water)	341	748	255	546	186
Paper m/c drain	607	1069	649	796	483
Total	*948*		*904*		*669*

The consumption pattern for major resources in the paper mill was also worked out based on the monthly consumption figures. The average per day consumption for the various resources used in paper mill are given in the following table

Paper Mill : Resources daily consumption (Average)

S.No.	**Resource**	**Consumption /d**
1	Fresh water	1020 m^3
2	Rosin	53 Kg
3	Alum	105 Kg
4	Steam	60 T
5	Electricity	9000 KWH

The production specific resources consumption and pollution load generation quantities for the paper mill are summarised in the table below

S.No.	Particulars	Quantity/d	Quantity/T of paper
1	Fresh Water Consumption (m^3)	1020	34
2	Rosin Consumption (Kg)	53	1.77
3	Alum Consumption (Kg)	105	3.5
4	Steam Consumption (T)	60	2
5	Electricity Consumption (KWH)	9000	300
6	Waste Water Generation (m^3)	948	31.26
7	COD Load Generation (Kg)	904	30.1
8	TSS Load generation (Kg)	962	22.3

Whole Pulp & Paper Mill

In order to assess the overall pollution load from whole of the pulp & paper mill, flow monitoring & sampling (continuous 24 hrs) was done at the inlet of ETP. The results obtained are as follows:

Waste Stream	**Flow (m3/d)**	**COD (mg/l)**	**COD Load (Kg/d)**	**TSS (mg/l)**	**TSS Load (Kg/d)**
Combined Effluent	3025	6570	9874	2884	8724

The production specific Water, Steam and Electricity consumption and pollution load generation quantities for whole of the pulp & paper mill are summarised in the table below

S.No.	Particulars	Quantity/day	Quantity/T of paper
1	Fresh Water Consumption (m^3)	3450	115
2	Steam Consumption (T)	120	4
3	Electricity Consumption (KWH)	18000	600
4	Waste Water Generation (m^3)	3025	101
5	COD Load Generation (Kg)	9874	329
6	TSS Load generation (Kg)	8724	290.8

"DESIRE" Project Impact

The table below provides a comparison of waste minimisation/cleaner production status between present scenario (i.e. Sep'98) and the one before the project DESIRE (i.e. Apr'93). The comparison has been made for the pulp mill, paper mill and the combined pulp & paper mill. The indicators used for the comparison purpose are Specific resource consumption and pollution load generation quantities.

CP Indicator	Start of project DESIRE (Apr'93)	Present Status (Sep'98)	Improvement (%)
Pulp Mill (Quantities per ton of finished paper)			
❑ Fibrous Material Consumption (T/T)	1.91	1.7	11
❑ Fresh Water Consumption (m^3/T)	117.4	81.0	31
❑ Caustic Flakes Consumption (Kg/T)	1.8	0.83	54
❑ Steam Consumption (T/T)	4.0	2.0	50
❑ Electricity Consumption (KWH/T)	400	300	75
❑ Waste Water Generation (m^3/T)	106.7	67.23	37
❑ COD Load Generation (Kg/T)	1043	624	40
❑ TSS Load generation (Kg/T)	334.5	622.7	16
Paper Mill (Quantities per ton of finished paper)			
❑ Fresh Water Consumption (m^3/T)	40.3	34.0	16
❑ Rosin Consumption (Kg/T)	3.0	1.77	41
❑ Alum Consumption (Kg/T)	7.0	3.5	50
❑ Steam Consumption (T/T)	2.5	2.0	20
❑ Electricity Consumption (KWH/T)	480	300	37
❑ Waste Water Generation (m^3/T)	36.7	31.6	14
❑ COD Load Generation (Kg/T)	47.0	30.1	36
❑ TSS Load generation (Kg/T)	31.0	32.07	28
Whole Mill (Quantities per ton of finished paper)			
❑ Fresh Water Consumption (m^3/T)	157.7	115	27
❑ Steam Consumption (T/T)	7.2	4.0	44
❑ Electricity Consumption (KWH/T)	880	600	32
❑ Waste Water Generation (m^3/T)	143	100.8	29
❑ COD Load Generation (Kg/T)	1094	662.5	39
❑ TSS Load generation (Kg/T)	365	220.2	20

3.2 PROJECT DESIRE

Post Project Evaluation

A. SECTOR - Textile Dyeing and Printing

1. UNIT - Garden Speciality Prints

During the project period, 38 Waste Minimisation (WM) options were identified of which 7 were rejected for some reason as given in detailed worksheets (Option Nos. 1,20,21,22,31,32,38).

Of the remaining 31 options, at the end of project period, 17 were already implemented, 10 were under implementation, 4 were yet to be implemented.

The situation changed slightly in the post project period. Of the 17 options which were implemented, 16 continued to be implemented and only one was discontinued due to technical problems. Of the 10 options which were under implementation, all of them got implemented. Of the 4 options for which the implementation was yet to start, 3 got implemented and one could not be implemented. Thus the number of implemented options rose from 17 to 29.

The best part was that the unit, on its own, identified a fresh set of 6 WM options (In fact, the number of new options identified were higher but no details were available for those which were not implemented). Out of which 4 were implemented and 2 are yet to be implemented.

The total number of options which were implemented as on Dec'97 is therefore 33.

The unit has so far made a total capital investment of Rs.39,20,000. The annual savings amount to Rs.45,21,000.

On the environmental front, there was no quantified data available. After monitoring by NPC impact of implemented options on environment will be evaluated.

LIST OF WASTE MINIMISATION OPTIONS DEVELOPED DURING PROJECT DESIRE

WASTE MINIMISATION OPTION	IMPLEMENTATION STATUS IN DEC '94
1. Caustic lye in lieu of caustic flakes	Reject
2. Diosyn HF in lieu of Hydro	Under Implementation
3. Ginasol in lieu of non-ionic detergent	Implemented
4. Use combination of mineral & organic acid for organic acid	Implemented
5. Formic acetic or catalyst DD in lieu of acetic acid	Implemented
6. Introduce dummy drum in lieu of dyeing m/c to have low ML to Cloth ratio	To be Implemented
7. Have dedicated m/c for white dyeing with dyebath reuse tank	Under Implementation
8. Have dedicated m/s for weight reduction with spent liquor recycle system	Under Implementation
9. Introduce spent hydro + caustic reuse tank in jet m/c	Implemented
10. Introduce press switch for the view glass light	Under Implementation
11. Condensate recovery	Under Implementation
12. Use soft water for cooling and recover for reuse as charge water	Implemented
13. Reuse recovered NaOH solution from soaper for various jets	Implemented
14. Use non-stick containers for print paste	To be implemented
15. Use hand pumps in lieu of mugs at printing table	Under implementation
16. Find alternatives for solvent based blanket cleaning agents	To be implemented
17. Use low grade gray cloth for initial printer table setting	Implemented
18. Switch over from hard rubber hose to translucent non-stick hose for print paste transfer	Implemented
19. Substitute citric acid with citric W	Implemented
20. Switch over to 100% automatic colour kitchen	Reject
21. Switch over from steam to thermic fluid drying	Reject
22. Pneumatic squeezee to magnetic rod in starmac rotary printer	Reject
23. Installation of doctor blades to recover blanket carryover print paste	Implemented
24. Above as in 23 with controlled water jet system for recovery	Implemented
25. Proper hardness setting	Under Implementation
26. Recovery of print paste from flat bed squeezee	Implemented
27. Recovery of print paste from rotary	Implemented
28. Introduce separate soaking tanks for squeezees and screens	Under implementation
29. Foot operated fog spray system for screen wash	To be implemented
30. Longer length for each colour match and design	Under implementation
31. Install self closing valves for all water hoses	Implemented
32. Installation of steam cut off controller at continuous direct steam injection places	Reject
33. Installation of squeezee rollers in chemical bath	Reject
34. Interconnection of two stage chemical bath tanks	Implemented
35. Replacement of globe valves by lever type valve to avoid leakage	Implemented
36. Recycling of acidic waste water from Soaper 1 & 3 to soaper 2	Under implementation
37. Use of spent acid from soaper for neutralisation of carry over alkali	Implemented
38. Use of weight reduction accelarators	Reject

Summary:

WM options implemented	17	CI	-	16
WM options under implementation	10	Discontinued	-	4
WM options to be implemented	4	Implemented	-	13
WM options rejected	7	Not Impl.	-	1
Total	38	To be Impl.	-	1
		Reject		3
				38

New Measures

Implemented	- 4
To be implemented	- 2
	6

OVERVIEW OF THE PROGRESS IN IMPOLEMENTATION OF THE WASTE MINIMISATION OPTIONS DEVELOPED AS PART OF PROJECT DESIRE

GARDEN SPECIALITY PRINTS

Description of the Waste Minimisation Option	Implementation status as on Dec'94	Economic benefits (only for implemented options)		Environmental benefits (only for implemented options)		Implementation status as on Dec'97	Remarks/ Comments
		Investment Cost	Net annual savings	Quantitative	Qualitative		
1. Caustic lye in lieu of caustic flakes.	Reject	50,000	Rs.1/Kg. 11T/mmX 12mm = Rs.132,000/year	Nil	Nil	Impl.	Handling and pilferage problem
2. Diosyn HF in lieu of Hydro	U.I.	Nil	28% cost reduction 108,000/year	87.5% COD reduction		Impl.	22% COD reduction in total COD load Dye house
3. Ginasol in lieu of non-ionic detergent	Impl.	Nil	52%	71% COD reduction		CI	from 480 to 380
4. Use combination of mineral & organic acid for organic acid	Impl.	Nil	(40% reduction in acid costs Rs.170,000/yr	40% COD		CI	
5. Formic acid or catalyst DD in lieu of acetic acid	Impl.	Nil	NQ		Reduction in COD	CI	
6. Introduce dummy drum in dyeing m/c to have low ML to cloth ratio	To be Impl.	NQ	NQ		Water energy & material saving	Discontinued due to quality problems	
*7. Have dedicated m/c for white dyeing with dyebatch reuse tank	UI	180,000	350,000	-	Conservation of water, energy & auxiliaries	Impl.	The implementation got delayed due to clearance from company consult
*8. Have dedicated m/c for weight reduction with spent liquor recycle system	UI	180,000	350,000	-	-do-	Impl.	

*9.	Introduce spent hydro & caustic reuse tank in jet m/c.	Impl.	270,000	500,000	-	Conser-vation of reducing chemicals	CI	
10.	Introduce press switch for the view glass light	UI	600	120,000	120,000	Reduction in energy consumption	Impl.	
11.	Condensate recovery	UI	NQ	NQ	-	Reduc. in energy & water	Impl.	
12.	Use soft water for cooling and recover for reuse as charge water	Impl.	NQ	NQ	NQ	Savings in energy	CI	
13.	Reuse recovered NaOH solution from soaper for various jets	Impl.	Nil	NQ	NQ	Reduc. in chemi-cals cons.	CI	
14.	Use non-stick containers for print paste	To be Impl.	NQ	NQ	NQ	Reduced paste loss and load reduction to ETP	Not Impl.	To check availabi-lity of containers. Container not available.
15.	Use hand pumps in lieu of mugs at printing table	UI	NQ	NQ	NQ	Reduc. in spills & material cons.	Discontin-ued	Workers did not lik this measure. High breakage of hand pumps hence high expenditure
16.	Find alternatives for solvent based blanket cleaning agents	To be impl.	NQ	NQ			To be implemented	Alternative agents yet to be found. Discussions going on with othe mills
17.	Use low grade gray cloth for initial printer table setting	Impl.	Nil	375,000	-	Savings in costly gray cloth	CI	To find out availability of such hoses
18.	Switch over from hard rubber hose to translucent non-stick hose for print paste transfer	Impl.	NQ	NQ	-	Reduc. in print paste loss	CI	A product 'Niravel tried
19.	Substitute citric acid with citric W	Impl.	NQ	NQ	-	Reduced cost and poll. Load	CI	Feasibility of installing to be worked out
20.	Switch over to 100% automatic colour kitchen	Reject	NQ	NQ	-	20-30% reduction in material loss	Impl.	Due to increased printing load the existing automatic colour kitchen is being fully used.

21.	Switch over from steam to thermic fluid drying	Reject	640,000	NQ	-	Energy savings	Impl.	8 flat bed m/c. already switched over. Remaining rotary to be switche over in June '98.
22.	Pneumatic squeezee to magnetic rod in starmac rotary printer	Reject	1,200,000 (Rs.150,000 per rod:8 rods/ mc	NQ	-	Quality improve-ment.	Impl.	Already implemented in one rotary. 2nd under implementation
23.	Installation of doctor blade to recover blanket carryover print paste	Impl.	NQ	35 Kg/mc of print paste Rs 586,000	Recovery of 35 Kg/mc of paste		CI	
24.	Above as in 23 with controlled water jet system for recovery	Impl.	NQ	-do-	-do-		CI	
25.	Proper hardness setting of squeezee	UI	NQ	NQ		Reduc. of print paste loss	Impl.	Calls for close monitoring
26.	Recovery of print paste from flat bed squeeze	Impl.	Nil	Rs 335,000 Recovery of 0.5 Kg per squeezee		Reduc. in pollution load	CI.	
27.	Recovery of print paste from rotary	Impl.		Rs. 95,000 Recovery of 0.8-0.9 Kg per rotrary screen		-do-	CI	
	Introduce separate soaking tanks for squeezees and screens	UI	NQ	NQ	Water savings by 50%		Imp.	Implemented fo plant
28.	Foot operated fog spray system for screen wash	To be impl.	NQ	NQ	70% water conservation		Impl.	Hand operated f spray system implemented
29.	Longer length for each colour match and design	UI	NQ	NQ	-	Reduced frequency of washing	Impl.	
30.	Install self closing valves for all water hoses	Impl.			Water reduc. 25m^3/hr.		CI	Requires coordination wi design and marketing deptt
31.	Installation of steam cut off controller at continuous	Reject					Reject	

	direct steam injection places in soaper						
32.	Installation of squeezee rollers in chemical bath	Reject				Reject	
33.	Interconnection of two stage chemical bath tanks	Impl.	NQ	NQ	NQ	CI	
34.	Replacement of globe valves by lever type valve to avoid leakage	Impl.	NQ	NQ	NQ	CI	
35.	Recycling of acidic waste water from Soaper 1 & 3 to soaper 2	UI	NQ	NQ	50% reduc. in water and acid cons. In Soaper 2	Disconti--nued Reject	Due to purchase of a bigger new soaper the measure has become redundant
37.	Use of spent acid from soaper for neutralisation of carry over alkali	Impl.	NQ	NQ	NQ	Disconti--nued	-do-
38.	Use of weight reduction accelerators	Reject				Reject	Trials done by supplier (M/s Dystar) so far not successful.
							Trials not successful so far by the supplie (Dystar)

'A1': Partially implemented. Old acid tank used by relining it with rubber.
* : Savings do not include heat savings only water & chemicals cost.

OVERVIEW OF THE PROGRESS IN IMPOLEMENTATION OF THE WASTE MINIMISATION OPTIONS DEVELOPED AS PART OF PROJECT DESIRE

GARDEN SILK MILLS - NEW OPTIONS

Description of the Waste Minimisation Option	Implementation status as on Dec'94	Economic benefits (only for implemented options)		Environmental benefits (only for implemented options)		Implementation status as on Dec'98	Remarks/ Comments
		Investment Cost	Net annual savings	Quantitative	Qualitative		
1. Use of effluent from demin water plant regeneration which contain upto 18% unused caustic soda in wt. Reducation in jet machine. The effluent about 15^3/day would be transferred by a pipeline. Cuastic required for process is presently 9T/month.	Impl.		Rs.1.0 lakh 13X 9000 X12= Rs.14.0 lakh				
2. Plan for the entire caustic in demin by reconcentrating through RO The high exit concentration now is due to limited capacity of demin plan and hence the need to recharge it fast. Ideally the concentration drop should be 15% to 5%. Here it is 25% to 18%.	To be Impl.						
3. Cloth to liquor ratio at the start of project was !:7 & has been reduced to 1:4.	Impl.						
4. Replaement of gwar gum with tamarind caramel powder. The lath is much easily biodegradable.	Impl.						
5. Old soaper replaced with new machine.	Impl.	13.00.000					

6.	Planning for switch over from coal to gas fired boiler and stemic fluid heaters.	To be Impl.

LEGEND:

NI - Not Implemented
Impl - Implemented
CI - Continues to be Implemented
UI - Under Implementation
NE - Not Evolved during project
NQ - Not Quantified

Waste Minimisation Progress Assessment
At
M/s Garden Vareli, Surat

Garden Special Prints is a leading integrated textile manufacturing unit having spinning, weaving and processing house at Vareli, near Surat in Gujurat. The project study was restricted to the processing house only with a focus on dyeing and printing sections. The processing capacity of the unit is 90,000 meters per day at present.

The present study was undertaken to assess the effect of the project DESIRE initiated in April '93. During and after the project period a number of Waste Minimisation options were identified and implemented which are given in the detailed worksheet. A brief about the different sections' waste water monitoring is given below.

DYEING

A total of 3 batches were monitored from the following sections so as to get a representative sample based on the present production trends (i.e 30,000m from plain dyed finish and 60,000m from bleaching).
One batch from "plain dyed finish".
Two batches of bleaching section only i.e. fabric ready for printing.

Batch 1

Date: 08.09.98 Quality: Aquamatt dress M:L 1:5
Process: Caustic drumming and dyeing as dyed goods.
Cloth processed: 2592 m. Liquor volume: 1300 l (make up)

Sl. No	Process Sequence	Discharge pH	Discharge volume in l	Wastewater COD in mg/l	COD load in gms/discharge
1	Cold wash	8.3	1300	50	65
2	Caustic treatment & Washes	9.8	3900	266	1037
3	Acid wash	7.0	1300	48	62
4	Dyeing	4.6	1300	341	443
5	Washes	7.3	3900	38	148
6	Finishing	7.1	1200	169	203
Total			**12900**	**152**	**1958**

Note: The waste from caustic treatment is recycled for unspent caustic reuse. However the COD load kept building up which is discharged at the end of the day.

Total volume of wastewater per batch: 12900 lts
Total COD load per batch: 1958 gms
Specific COD load: 0.76 gms/linear meter
Total volume from plain dyeing: 148.8 m3

Batch 2

Date: 09.09.98 Quality: Aquamatt dress M:L 1:5
Process: Caustic drumming and dyeing as dyed goods.
Cloth processed: 2554 m. Liquor volume: 1300 l (make up)

Sl. No	Process Sequence	Discharge pH	Discharge volume in l	Wastewater COD in mg/l	COD load in gms/discharge
1	Cold wash	8.3	1300	52	68
2	Hot wash	7.8	1300	65	85
3	Caustic treatment & Washes	9.5	2600	305	793
4	Hot wash	7.5	2600	112	291
5	Acid wash & plain wash	6.4	2600	45	117
Total			**10,400**		**1354**

Total volume of wastewater per batch: 12900 lts
Total COD load per batch: 1354gms

Batch 3

Date: 10.09.98 Quality: Aquamatt dress M:L 1:5
Process: Caustic drumming and dyeing as dyed goods.
Cloth processed: 2522 m. Liquor volume: 1300 l (make up)

Sl. No	Process Sequence	Discharge pH	Discharge volume in l	Wastewater COD in mg/l	COD load in gms/discharge
1	Cold wash	8.2	1300	62	81
2	Hot wash	7.4	1300	70	91
3	Caustic treatment & Washes	9.1	2600	320	832
4	Hot wash	7.2	2600	100	260
5	Acid wash & plain wash	6.5	2600	59	153
Total			10400		1417

Total volume of wastewater per batch: 10400 lts
Total COD load per batch: 1417 gms

For batches 2 and 3
Average COD load 1386gms
Average Specific COD load: 0.55gms/linear meter

Total volume of wastewater from dyeing section: 249.6 m3

SOAPER

Total Fabric processed	90,000m/day
Waste water quantity	100m3/day
Waste water COD	97mg/l

DYEING SECTION

Total Flow:

From dyeing batches	148.8m3
From bleaching batches	249.6m3
From soaper	100.0m3

TOTAL **498.4 m3 per day**

Wastewater generated per meter of cloth **5.54 lts**

Total COD load:

From Dyeing batches:	23.5 Kgs
From Bleaching batches	33.3 Kgs
From Soaper	9.7 Kgs

TOTAL **66.5 Kgs per Day**

Specific COD load **66.5*(1000/90,000) = .74 gms per meter of fabric**

PRINTING SECTION

SECTIONS	Waste Water Flow in m3/day	COD in mg/l	COD Load in Kgs/day
Printing waste water	50	2022	101
Printing Machines (10 Nos)	610	198	121
Washings (Screens, Containers, Squeeze	40	9223	369
TOTAL	**700**	**843**	**591**

TOTAL MILL

Samples were taken from the ETP inlet for 24 Hrs at 30 minutes interval so as to get a representative test sample. The average flow and COD analysed is as follows

Measured Flow	1210 m3/day
COD	579mg/l
COD Load:	701Kgs/day

"DESIRE" Project progress

The tables below provides a comparison of waste minimisation status between the present (i.e. Sep'98) and the one before the start of the project DESIRE (i.e. Apr'93). The comparison has been made for the Dyeing, & Printing sections, and the mill as a whole. The indicators used for the comparison purpose are Specific resource consumption and pollution load generation quantities.

QUANTITATIVE ASSESSMENT OF THE TEXTILE MILL (Per day)

SECTION	PARAMETERS	Apr '93	Sept 98
Dyeing	Capacity m/day	30,000	30,000
	Flow m3/day	650	498.4
	COD load Kgs/day	232	66.5
	Dye Stuff Kgs/day	70.5	63.0
	Caustic (Lye) Kgs/day	90.0	42.0
Printing	Capacity m/day	50,000	60,000
	Flow m3/day	850	700
	COD load Kgs/day	1041	591
	Gum powder Kg/day	572	576
	Print Paste T/day	5	5
Whole Mill	Capacity m/day	80,000	90,000
	Flow m3/day	1500	1210
	COD load Kgs/day	1275	701
	Electricity units/day *	1700	1800
	Steam T/day *	100	85

* **Electricity, steam and natural gas consumption for individual sections is not available because of absence of meters**

QUANTITATIVE ASSESSMENT OF THE TEXTILE MILL (per m of cloth)

SECTION	PARAMETERS	Apr '93	Sept 98	Improvement %
Dyeing	Capacity m/day	30,000	30,000	0
	Flow m3/day	21.7	16.6	23.5
	COD load gms/m	7.7	2.21	71.3
	Dye Stuff gms/m	2.35	2.1	10.6
	Caustic (Lye) gms/m	3	1.4	53.3
Printing	Capacity m/day	50,000	60,000	20
	Flow lts/m	17	11.7	31.4
	COD load gms/m	20.8	9.9	52.4
	Gum powder gms/m	11.4	9.6	15.8
	Print Paste gms/m	100	83.3	16.7
Whole Mill	Capacity m/day	80,000	90,000	12.5
	Flow lts/m	18.8	13.4	28.7
	COD load gms/m	16	7.8	51.3
	Electricity units/1000m*	21	20	4.8
	Steam Kgs/1000 m*	1250	940	24.8

* **Electricity, steam and natural gas consumption for individual sections is not available because of absence of meters**

3.3

PROJECT DESIRE

Post Project Evaluation

A. SECTOR - Textile Dyeing and Printing

1. UNIT - Paradise Prints

During the project period, 32 Waste Minimisation (WM) options were identified of which 4 were rejected for some reason as given in detailed worksheets (Option Nos. 1,2,20, 26).

Of the remaining 28 options, at the end of project period, 12 were already implemented, 11 were under implementation, 5 were yet to be implemented.

The situation changed slightly in the post project period. Of the 12 options which were implemented, 11 continued to be implemented and only one was discontinued due to technical problems. Of the 11 options which were under implementation, 6 got implemented and the remaining 5 were discontinued/rejected. Of the 5 options for which the implementation was yet to start, only 1 got implemented. Thus the number of implemented options rose from 12 to 18.

The best part was that the unit, on its own, identified and implemented a fresh set of 21 WM options (In fact, the number of new options identified were higher but no details were available for those which were not implemented).

The total number of options which were implemented as on Dec'97 is therefore 39.

The unit has so far made a total capital investment of Rs.49,000. The annual savings amount to Rs.286,000.

On the environmental front, the unit has been able toreduce the COD discharge by 4281 Kg/month (51.4 tons/year). There has been more than 50% COD reduction in respective waste streams in 7 options. The water consumption has come down by 9180 m3/month with 3 options resulting in more than 50% reduction in respective waste streams.

OVERVIEW OF THE PROGRESS IN IMPLEMENTATION OF THE WASTE MINIMISATION OPTIONS DEVELOPED AS PART OF PROJECT DESIRE

PARADISE PRINTS (TEXTILE DYEING AND PRINTING SECTOR)

Description of the Waste Minimisation Option	Implementation status as on Dec'94	Economic benefits (only for implemented options)		Environmental benefits (only for implemented options)		Implementation status as on Dec'97	Remarks/ Comments
		Investment Cost	Net annual savings	Quantitative	Qualitative		
1. Caustic lye in lieu of caustic flakes.	Reject	Nil	NQ		Nil	Reject	Rejected due to problem in procurement and storage
2. Na2CO3 in lieu of NaOH flakes	Rject.	Nil	NQ		Nil	Reject	Na_2CO_3 cannot c weight reduction
3. Diosyn HF in lieu of Hydro sulphite	Impl.	Nil	43% cost reduction Rs.5,000	COD Reduc. 182 Kg/m 87%		CI	
4. Ginasol 6836 in lieu of nonionic detergent	Impl.	Nil	52% cost reduction Rs.14,000	COD Reduc. 377 Kg/m 71%		CI	
5. Citric acid by citric W	Impl.	Nil	30% cost reduction Rs.45,000	COD red.	600 Kg/m (97%)	CI	
6. Formic acid or catalyst DD in lieu of acetic acid	Impl.	Nil	Rs.23,000	COD red.	1200 Kg/m (93%)	CI	
7. HICO leveller BJD in lieu of castor oil ethoxylate	To be Impl.	Nil	Rs.2,000	COD red.	50 Kg/m (70%)	Imp.	
8. Sequacel HD in lieu of EDTA TSPP & NTA	UI	Nil	Rs.15,000	COD red.	182 Kg/m (87%)	Imp.	

9.	Replace beam dyeing machine by Jet dyeing machine	Impl.	Nil (replace-ment by existing m/c.)				Discontinued	Discontinued due to non-availability of dyeing machine
10.	Dye bath reuse thro' and O.H. tank	Impl.	Rs.10000	10,000	Effluent reduc. 100 kilolitres /month 70% reduc. in dyeing effluent		CI	
11.	Insultation of above OH tank	Impl.	Rs.1,000	1,000	-	Reduc. in energy consumption	CI	
12.	Operation of reduced CL ratio from 1:3 to 1:2.2	UI.	NQ	NQ	NQ		Rejected due to quality problems	Fabric enlargement. Further trials in progress
13.	Introduce press switch for view glass light	UI	Rs.1000	10000/yr	NQ	Reduc. in energy cons.	Imp.	
14.	Introduce cold wash before scouring	Impl.	Nil	Rs.19,000	NQ	Reduced effluent load	CI	
15.	Condensate Recovery	Impl.	NQ	NQ	NQ	Reduc. in energy cons.	CI	
16.	Lagging of condensate return lines	Impl.	Rs.1000	2,000	NQ	Reduced energy consumption.	CI	
17.	Use soft water for cooling and collect it in condensate tank for reuse in jet machine & boiler	UI	NQ	NQ	NQ	NQ	Imp.	
18.	Use of wash cooling water in jet dyeing machine	Impl.	NQ	NQ	NQ	NQ	CI	
19.	Use of modified edible oils in lieu of stowing thinner for blanket cleaning	UI	NQ	NQ	NQ	NQ	Discontinued due to high cost	Needs major retrofi & regular skilled

20. Manual to pneumatic operation for screen printing	Reject	-	-	-	-	Reject	maintenance
21. Installation of doctor blade to wipe off excess print paste from blanket with or without on/off water spray	UI	Rs.10000	Print paste recovery 100 Kg/d Rs.120,000/Yr	COD reduction 1400Kg/m		Imp.	
22. Install water recirculation system after 21	UI.	Rs.3,000	13,000	Water cons. Reduced by 7280 Kl/m	-	Imp.	
23. Introduce simple implement like wiper for recovery of print paste from sqeezee	UI.	Rs.1,000	6,000	NQ	NQ	Imp.	
24. Introduce pre-soaking tanks for squeezes & screen before washing	Plans made for trials. To be impl.	NQ	Nil	50% water reduction. Segregation of low value high strength waste water		Not imple-mented since no financial benefits	
25. Install foot operated fog spray system for screen wash	To be Impl.	NQ	NQ	NQ		Not imple-mented	Space required Not available
26. Increase number of chambers from 3 to 5	Reject.	-	-	-	-	Reject	Space constrain Addition of one chamber under consideration
27. Installation of individual piping for circulation of thermic fluid	To be impl.	48,000	120,000	NQ	Reduc. of thermal energy consumption	Not imple-mented	Technically not feasible
28. Vacuum slit for reduction of moisture content	Impl.	Rs.2,000	1,000	NQ	NQ	CI	
29. Reduce air flow to the stenter by using lower size pulley for fans, with or without damper adjustment	UI	-	-	-	-	Rejected	Decrease in ou from stenters
30. Stop vacuum pump during heat setting	To be tried.					Rejected	Technically not feasible

31. Replacement of continuous water wash with a 2 stage presoaking fill & draw type bath in weight reduction	UI	36,000	54,000	Reduct. of alkali loss	Rejected	Adverse impact on production rate
32. Replacement of manual washing with continuous washing	UI	750000	1080,000	50% reduct. in effluent value	Rejected	High capital investment

LEGEND:

NI - Not Implemented
Impl - Implemented
CI - Continues to be Implemented
UI - Under Implementation
NE - Not Evolved during project
NQ - Not Quantified

Note: Combined savings of options 3,4,5,6 Rs.105,000/year and environmental benefit of COD Load reduction by 3070 Kg/month.

Investment made - 834,000 ; Savings 1,659,000

In the first two years, COD discharge has been reduced from 150Kg/m of fabric to 80 Kg/pm fabric. In term of concentration from 252 mg/l to 51 mg/l.

LIST OF NEW WM OPTIONS

OVERVIEW OF THE PROGRESS IN IMPLEMENTATION OF THE WASTE MINIMISATION OPTIONS DEVELOPED AS PART OF PROJECT DESIRE

PARADISE PRINTS

Description of the Waste Minimisation Option	Implementation status as on Dec'94	Economic benefits (only for implemented options)		Environmental benefits (only for implemented options)		Implementation status as on Dec'97	Remarks/ Comments
		Investment Cost	Net annual savings	Quantitative	Qualitative		
1. Parcial replacement of oxalic acid with HCl	NE	Nil	Rs.10,000	COD reduc. 90Kg/month (40%)		Imp.	
2. Elimination of Carcinogenic acid dyes	NE.	Nil	Nil	NQ	Carcinogens eliminated	Imp.	
3. Elimination of carcinogenic direct dyes	NE	Nil	Nil	NQ	Carcinogens eliminated	Imp.	
4. Elimination of carcinogenic TCS based carrier	NE	Nil	Rs.500	NQ	Carcinogens eliminated	Imp.	
5. Replacement of phenol with DEG	NE	Nil	Rs.6,000	COD reduct.. (100%)	Highly toxic compound 200 Kg/m elimj-nated	Imp.	
6. Elimination of CCl4 based stain remover	NE	Nil	Rs.1500	COD reduc. 1200 Kg/m (93%)		Imp.	
7. Elimination of Defoamer from Dye recipes	NE	Nil	Rs.8,000	COD reduc. 50 Kg/m (70%)		Imp.	
8. Replacement of gum containing PCP	NE	Nil	Nil	NQ	Carcnogen eliminated	Imp.	

9.	Substitution of kerosene with acrylic thickener	NE	Nil	Rs.8000	NQ	Improved air quality and reduced fire hazard	Imp.
10.	Elimination of caricinogenic Formaldehyde resins.	NE	Nil	Nil	NQ	Carcinogen eliminated	Imp.
11.	One bath oxalic and whitening treatment	NE	Nil	106,200	1800 cum/month water saving. 900 Kg acid saving 75 Kg/batch steam saving		Imp.
12.	Optimisation of scouring and dyeing chemicals	NE	NQ	3,000	NQ	Reduced effluent load	Imp.
13.	Installation of water level controller in overhead tanks	NE	NQ	NQ	NQ	Water conservation	Imp.
14.	Reduce edge carryover in printing machines	NE	Nil	6,000	NQ	Reduced wastewater loading	Imp.
15.	Improved boiler efficiency through regular oxygen analysis	NE	18,000	35,000	NQ	Reduced GHG emission load	Imp.
16.	Rain water collection and bore well recharging	NE	NQ	NQ	NQ	Reduced water hardness & TDS	Imp.
17.	Insulation of boiler	NE	2,000	3,000	NQ	Energy conservation	Imp.
18.	Reuse of plastic wrapper and bags in house	NE	Nil	NQ	NQ	Reduced solid waste	Imp.
19.	Reuse of paper	NE	Nil	NQ	NQ	Reduced solid waste	Imp.
20.	Insulation of heat recovery unit	NE	NQ	NQ	NQ	Reduced GHG emission	Imp.

21. Avoid drying stage between washing and finishing	NE	Nil	9,000	NQ	Reduced GHG emission	Imp.

Waste Minimisation Progress Assessment
At
M/s Paradise Prints, Surat

Paradise Prints is job work textile processing house located in Surat, Gujurat. The processing capacity at present is 53,000 meters per day. The present study was undertaken to assess the effect of the project DESIRE initiated in April '93. During and after the project period a number of Waste Minimisation options were identified and implemented which are given in the detailed worksheet.
A brief about the different sections' waste water monitoring is given below.

A total of 3 batches were monitored from the dyeing section.

DYEING

Batch 1

Date: 11.09.98 M:L 1:3
Cloth processed: 2020 m. Liquor volume: 350 lts (make up)

Sl. No	Process Sequence	Discharge pH	Discharge volume in l	Wastewater COD in mg/l	COD load in gms/discharge
1	Cold wash	7	350	2737	958
2	Scouring & Weight reduction	11	350	2894	1013
3	Hot wash	10.2	350	3214	1125
4	Cold Wash	8.3	350	730	256
5	Acid wash	4	350	260	91
6	Cold washes	6.8	350	277	97
7	Dyeing (Spent bath) – Recycled	5.2	45	2308	104
8	Cold Wash (3washes)	7	1050	120	126
Total			**3195**	**1180**	**3770**

Note: The waste from dyeing stage is recycled. Make up has been averaged to 45l. However the COD load kept building up which is discharged at the end of 8 to 10 batches.

Total volume of wastewater per batch: 3195 lts
Total COD load per batch: 3770 gms

Batch 2

Date: 11.09.98 M:L 1:3
Cloth processed: 1915 m. Liquor volume: 350 lts (make up)

Sl. No	Process Sequence	Discharge pH	Discharge volume in l	Wastewater COD in mg/l	COD load in gms/discharge
1	Cold wash	7	350	2651	928
2	Scouring & Weight reduction	11.4	350	2820	987
3	Hot wash	10.4	350	2863	1002
4	Cold Wash	8.5	350	756	265
5	Acid wash	3.7	350	277	97
6	Cold washes	7.0	350	257	90
7	Dyeing (Spent bath)	5.4	45	297	14
8	Cold Wash	7.1	1050	114	120
Total			**3195**	**1096**	**3503**

Note: The waste from dyeing stage is recycled. Make up has been averaged to 45l. However the COD load kept building up which is discharged at the end of 8 to 10 batches.
Total volume of wastewater per batch: 3195 lts
Total COD load per batch: 3503 gms

Batch 3
Date: 12.09.98 M:L 1:3
Cloth processed: 1932 m. Liquor volume: 350 lts (make up)

Sl. No	Process Sequence	Discharge pH	Discharge volume in l	Wastewater COD in mg/l	COD load in gms/discharge
1	Cold wash	6.9	350	2686	940
2	Scouring & Weight reduction	10.8	350	2846	996
3	Hot wash	10.5	350	2900	1015
4	Cold Wash	8.1	350	704	246
4	Acid wash	4.4	350	289	101
6	Cold washes	6.9	350	263	92
7	Dyeing (Spent bath)	5.0	45	2331	105
8	Cold Wash	7.1	1050	111	117
Total			**3195**	**1130**	**3612**

Note: The waste from dyeing stage is recycled. Make up has been averaged to 45l. However the COD load kept building up which is discharged at the end of 8 to 10 batches.
Total volume of wastewater per batch: 3195 lts
Total COD load per batch: 3612 gms

DYEING SECTION

Average COD load per batch: **3628 gms**
Total volume from dyeing section: **80 m3/day**

Wastewater generated per meter of cloth **1.6 lts.**

Total COD load: From Dyeing batches: **72.6 Kgs/day**

Specific COD load **1.4 gms per meter of fabric**

PRINTING SECTION

SECTIONS	Waste Water Flow in m3/day	COD in mg/l	COD Load in Kgs/day
Print washing waste water	20	1508	30
Print Blanket washing - waste water (8 Nos)	180	109	19.6
Washings (Screens, Containers, Squeeze)	155	1463	226.8
Finishing	40	55	2.2
TOTAL	**395**	**705**	**278.6**

TOTAL MILL

Samples of wastewater were taken from the ETP inlet for 24 Hrs at 30 minutes interval so as to get a representative test sample. The average flow and COD analysed is as follows:

Measured Flow 520 m3/day
COD 642 mg/l
COD Load: 334 Kg/day

"DESIRE" Project Impact

The tables below provides a comparison of waste minimisation status between the present (i.e. Sep'98) and the one at the start of the project DESIRE (i.e. Apr'93). The comparison has been made for the Dyeing & Printing sections, and the mill as a whole. The indicators used for the comparison purpose are Specific resource consumption and pollution load generation quantities.

QUANTITATIVE ASSESSMENT OF THE TEXTILE MILL (Per day)

SECTION	PARAMETERS	Apr '93	Sept 98
Dyeing	Capacity m/day	50,000	53,000
	Flow m3/day	120	80
	COD load Kgs/day	156	72.6
	Dye Stuff Kgs/day	110	81
	Caustic consumption (Lye) Kg/day	55	31
Printing	Capacity m/day	50,000	53,000
	Flow m3/day	707	395
	COD load Kgs/day	464	278.6
	Gum powder consumption Kg/day	310	230
	Print Paste T/day	NA	NA
Whole Mill	Capacity m/day	50,000	53,000
	Flow m3/day	827	520
	COD load Kgs/day	620	334
	Electricity units/day *	3500	3200
	Natural Gas m3/day *	4500	3400

* **Electricity, and natural gas consumption for individual sections is not available because of the absence of meters**

NA Not available

QUANTITATIVE ASSESSMENT OF THE TEXTILE MILL (per m of cloth)

SECTION	PARAMETERS	Apr '93	Sept 98	Improvement %
Dyeing	Capacity m/day	50,000	53,000	6
	Flow m3/day	2.4	1.5	37.5
	COD load gms/m	3.12	1.4	55.1
	Dye Stuff gms/m	2.2	1.5	31.8
	Caustic consumption (Lye) gms/m	1.1	.58	47.3
Printing	Capacity m/day	50,000	53,000	6
	Flow lts/m	14.4	7.5	47.9
	COD load gms/m	9.3	5.3	43
	Gum powder consumption gms/m	6.2	4.3	30.6
	Print Paste gms/m	NA	NA	--
Whole Mill	Capacity m/day	50,000	53,000	6
	Flow lts/m	16.5	9.8	40.6
	COD load gms/m	12.4	6.3	49.2
	Electricity Kwh/1000m*	70	60.4	13.7
	Natural Gas NM3/1000m*	90	64.2	28.7

* **Electricity, and natural gas consumption for individual sections is not available because of the absence of meters**

The unit recycles water by using the treated effluent for different purposes including process and domestic uses such as toilet flushing.

3.4

PROJECT DESIRE

Post Project Evaluation

B. SECTOR - Pesticides Formulation

1. UNIT - Vimal Pesticides Pvt. Ltd.,

During the project period, 64 Waste Minimisation (WM) options were identified of which 26 were rejected mainly due to poor techno-economic feasibility as given in detailed worksheets.

Of the remaining 38 options, at the end of project period, 25 were already implemented, 2 were under implementation, 11 were yet to be implemented.

The situation changed in the post project period. Of the 25 options which were implemented, 22 continued to be implemented and only 3 were discontinued due to technical problems. Of the 2 options which were under implementation, both got implemented . Of the 11 options for which the implementation was yet to start, only 7 got implemented. Even of the 26 rejected options, 3 were found to be attractive and were implemented. Thus the number of implemented options rose from 25 to 34.

The best part was that the unit, on its own, identified and implemented a fresh set of 6 WM options (In fact, the number of new options identified was higher but no details were available for those which were not implemented).

The total number of options which were implemented as on Dec'97 is therefore 40.

The unit has so far made a total capital investment of Rs.390,000. The annual savings amount to Rs.730,100.

On the environmental front, there was no quantified data available on pollution reduction, since most of the pollution is fugitive in nature. However, in some cases (options No.23, 24, 52, 54, 62, 64, New 1, New 2, New 4, New 5) more than 50% reduction in toxic waste was achieved.

Financial Analysis for additional WM options implemented between Dec'95 & Dec'97.

Option No.	Investment	Saving
New 1	120,000	132,000
New 2	20,000	45,000
New 4	40,000	4,800
New 5	27,000	200,000
Old 6	1,000	Nil
Old 8	500	Nil
Old 12	4,000	6,000
Old 17	110,000	Nil
Old 42	2,000	Nil
Old 57	1,000	Nil
	345,500	387,800

Financial Analysis for additional WM options implemented in Dec'94.

Option No.	Investment	Saving
3	15,000	500
4	500	Nil
5	5,000	Nil
14	1,000	Nil
16	1,000	Nil
23	Nil	15,800
24	Nil	13,500
26	15,000	Nil
30	6,000	300,000
39	Nil	10,500
54	1,000	Nil
64	Nil	2,000
	44,5000	342,300

Status of Implementation in Dec'97

Continued to be implemented		-	22
Earlier identified options implemented		-	9
Earlier identified options not implemented		-	4
Implemented options discontinued		-	3
Option rejected earlier but implemented		-	3
Options rejected		-	23
			64
New options identified & implemented		-	6
Total options implemented	- 34+6	=	40
Total options not implemented		=	7
Total options rejected		=	23
			70

NEW OPTIONS

OVERVIEW OF THE PROGRESS IN IMPLEMENTATION OF THE WASTE MINIMISATION OPTIONS DEVELOPED AS PART OF PROJECT DESIRE

VIMAL PESTICIDES LTD.,

1) The new blender is on a load cell for accumulating weigh for input material.

   Inv. - Rs. 1,20,000; Manpower reduced from 6 to 4 = Rs.72,000/year plus savings due to reduced reprocess due to 0% = Rs.72,000/year

2) The double bar balance has been replaced with higher accuracy electronic balance.

   Inv. - Rs.40,000 Saving - a) Reprocessing reduced <1% from 2.5% - Rs.45,000/year
   b) Significant reduction in exposure of workers to toxic material. Reprocessing is the single highest cause of exposure.
   c) Manpower reduced from 4 to 3.

3) The scheme at 2 is going to be extended to the other 4 blenders which were installed 2 years back.

4) Refer Item 28 - Instead of vacuum cleaner, three flipper cleaner machine has been introduced which do not require any electrical power.

   Cost - Rs.13,500 each (total Rs.40,000). Saving - 1 Kg/day of granule = 150 Kg/year @ Rs.22/Kg = Rs.3300/year; Dust 150 KgX19 Rs/Kg = Rs.1500/year. Re-entrainment of dust totally avoided.

5) Refer 32; torque gear concept replaced by fluid comply. Successfully implemented. I - Rs.27,000, Savings = Approx Rs.200,00 depends on number of trippings.

6) Refer 48 - Weight being done by electronic balance.

OVERVIEW OF THE PROGRESS IN IMPLEMENTATION OF THE WASTE MINIMIZATION OPTIONS DEVELOPED AS PART OF PROJECT DESIRE

(PESTICIDES FORMULATION SECTOR)

VIMAL PESTICIDES LIMITED

Description of the Waste Minimization Option	Implementation Status as on Dec'94	Economic benefits (only for implemented option)		Environmental benefits (only for implemented options)		Implementation Status as on Dec'97	Remarks/ Comments
		Investment Cost	Net annual savings	Quantitative	Qualtative		
A. GRANULE PLANT 1. Periodic checking and repair of pumps, valves, flanges and lines in technical handling area	Imp	Nil	NQ	NQ	Better plant appearance. Reduced fumes due to less spillage of technical.	CI	
2. Periodic replacement of sealings etc. of transfer pump (rosin & solvent mix)	Imp	Nil	NQ	NQ	-do-	CI (every 15 days)	
3. Extraction of fumes from the generation/discharge points of blender	Imp	Rs.15,000	Rs. 500	NQ	Improvement in shop floor air quality	CI	i) ii) iii) iv)

4. Extraction of fumes from spray container	Imp	Rs. 500	Nil	NQ	Improvement in shop floor	CI	--
5. Extracting the fumes generated from rosin solvent mixer and discharging the same above roof	To be imp.	Rs. 5,000	Nil	NQ	Improvement in shop floor air quality	Not implemented. Likely to be implemented by June, 1998	The existing blower capacity not enough. Larger blower cannot be installed due to electrical load restrictions.
6. Closing the blender charge hopper	Reject	Rs. 1,000	Nil	NQ	Reduced fume and dust emission	Imp	A heavy plate is now placed at the platform
7. Closing all the opening of the blender	Reject	--	--	--	--	Reject	Technically not feasible.
8. A pump holder with a tray should be made for keeping the hand pump after its use	To be imp	Rs. 500	Nil	NQ	Minor impact on shop floor environment	Imp	Further being modified by using an electric pump. This option would then become redundant
. Usage of better quality of gunny bags for the storage of granules	Imp	NQ	NQ	Reduced below charge for housekeeping Rs.36,000	Better plant appearance. Less solid waste	CI Further improvement that torn gunny bags are not being returned to the supplier	Granules are inexpensive and spillage is a very small proportion of quantitity used

10. Volumetric weighing and pneumatic transfer of granules	Reject	--	--	--	--	Reject	Economically not viable
11. Volumetric weighing and mechanical (pumping) charging of technical in close loop system	Reject	--	--	--	--	Reject	Technically and economically not feasible.
12. Enclosing the conveyor belt	Reject	Rs. 4,000	Rs. 6,000	0.2% wastage avoided (3.6 T/year)		Imp. Top fully covered. Bottom only 50% to avoid any jamming of material	Technically not feasible
13. Reducing inclination of the belt conveyor	Reject	--	--	--	--	Reject	Economically not feasible
14. Reducing speed of the belt conveyor	Imp	Rs. 1,000	Nil	NQ	Reduced spillage	CI	--
15. Installation of a simple bag clamping arrangement along with laminar plates at product holding silo	Reject	--	--	--	--	Reject	Technically not feasible
16. Installing a Doctor's Knife at the belt discharge point.	Imp	Rs. 1,000	Nil	NQ	Reduced spillage	Discontinued	Adverse impact on belt was observed
17. Installing a new line including conveyor belt and storage hopper.	To be imp	Rs.11,000	NQ		Reduced shop floor emissions	Imp.along with a scrubber	--

18.Placement of tray beneath the technical transfer valve (from drum to volumetric measuring tank) and technical spray pump and recycle the collected material.	Imp	Nil	NQ	NQ	Reduced vapors of technical in shop floor area	CI	--
19. Placement of a tray beneath the mixer to collect the spilled material and recycle the same.	Imp	NQ	NQ	NQ	Better plant appearance. Reduced solid waste	CI	
20. Recovery of chemicals from the extracted fumes (rosin & solvent mixer)	Reject	--	--	--	--	Reject	Economically not feasible
21. Scrubbing the fumes and fine dust emissions before discharging into the atmosphere.	To be imp.	Included in No.3 (Rs.15,000)	Nil	NQ	Significant impact on reduced toxic vapor emission	Imp. Instead of scrubber a dust collector has been installed	
22. Recovering the phorate from the scrubbed liquor.	Reject	--	--	--	--	Reject	Economically not feasible
23. Recovery of the residual technical material by keeping the drum in inverted position for some time.	UI	Nil	Rs.15,800/yr.	Technical discharge in environment reduced by 100 kg/year	--	Imp	

36. Recovery of chemicals from extracted emissions (from technical handling area) stream.	Reject	NQ	Nil	NQ	Improvement in shop floor air quality	Reject	Technically and economically not viable
37. Charging of contaminated solvent used in cleaning of transfer pump.	To be imp	Nil	Nil	NQ	Disposal of waste solvent eliminated	Not required since product specific transfer pump ID is used, hence no need of cleaning	
38. Cleaning of spray nozzles and charging of solvent used to the blender.	To be imp	Nil	Nil	NQ	Minor	Imp	
39. Recovery of the residual technical material by keeping the drum in the inverted position for some time.	Imp	Nil	Rs.10,500 per year	Technical discharge into environment reduced by 70 kg/yr.	--	CI	
40. Rinsing of the drum with suitable solvent and recycle the collected material in next batch or sell it to other formulators.	Imp	Nil	Same as above		--	CI	

C. LIQUID FORMULATION PLANT							
41. Periodic replacement of worn out sealing, gaskets etc. of all pumps (including hand pump)	Imp	Nil	Nil	NQ	Minor impact on environment	CI	
42. Replacement of all loose pipes/fittings with fixed pipes/fittings.	To be imp	< Rs. 2,000	Nil	NQ	Minor impact on environment	Imp. (Continuous process)	
43. Keep the empty containers directly in the rinsing container, instead of intermittent storage (reprocessing)	To be imp	Nil	NQ	NQ	Reduction in discharge of toxic waste	Discontinued. Since there is no need of rinsing	
44. Close all openings of the blender	Reject	--	--	--	--	Reject	Technically not feasible
45. Extraction of fumes at generation/ discharge points	Imp	Nil	NQ	NQ	Improved shop floor air quality	CI	The existing extraction system has been modified
46. Extraction of unavoidable fumes generated in packing operation.	Imp	Nil	NQ	NQ	Improved shop floor air quality	CI	The existing extraction system has been modified

47. Procurement of bottles/container of better quality.	Reject	Nil	NQ	NQ	NQ	Imp. As part of ISO 9000 of system	Beyond the scope of company
48. Volumetric weighing and mechanical (pumping) charging of technical, emulsifier in close loop system.	Reject	NQ	NQ	NQ	Minor effect on environment	Reject	Economically not viable
49. Pneumatic charging of solid materials.	Reject	NQ	--	--	--	Reject	Economically not viable
50. 100% leak testing of containers/bottles before filling with the product.	Reject	Rs.110,000	Rs.210,000	NQ	NQ	Reject	Economically not viable
51. A pump holder with a tray for keeping the hand pump after its use.	To be imp	Rs. 500	Nil	NQ	Minor impact on environment		Not required. Since hand pump replaced by Electric pump
52. The drum opening can be closed by providing a loosely fitting cork through which the transfer pipe should be inserted.	Imp	Nil	NQ	NQ	Improved shop floor air quality	CI	
53. Closing the open top container with an appropriately designed cover.	Reject	Rs. 1,500	NQ	NQ	Improved shop floor air quality	Reject	Technically not viable

54. Provide a mesh between the conveyor and the heating region of the shrink packing machine.	Imp	Rs.1,000	NQ	NQ	Minor impact on environment	CI	
55. Replace the conveyor with reduced gap link system.	Reject	Very expensive	NQ	NQ	Minor impact on environment	Reject	Economically not viable
56. Reduce the gap between the links by winding the links with an asbestos rope of 5 mm.	Reject	NQ	NQ	NQ	Minor impact on environment	Reject	
57. Close the inlet and outlet doors of shrink machine with a flexible asbestos sheet with a provision to increase/reduce openings as per bottle size.	To be imp	Rs. 1,000	NQ	NQ	Minor impact on environment	Imp	A better quality material, Teflon cloth is being used.
58. Placing the packed bottles/containers over a big tray for recovering the waste from leaking ones.	Reject	Rs.10,000	NQ	NQ	NQ	Reject	Economically not viable. Required space not available
59. Recycle/recovery of cheaper solvent used for cleaning of transfer pumps. The used solvent could be distilled and recycled.	Reject	>Rs.500,000	NQ	NQ	NQ	Reject	Economically not viable

60. Installation of recovery system from extracted air before discharging it into the atmosphere (charging, blending).	Reject	NQ	NQ	NQ	NQ	Reject	Economically not viable. Quantity recoverable is very small
61. Recovery of chemicals from extracted fumes. The used solvent could be distilled and recycled (packing)	Reject	NQ	NQ	NQ	Improved shop floor air quality	Reject	Economically not viable
62. Recovery technical material by keeping the drum in inverted position for some time.	Imp	Nil	NQ	NQ	Reduced toxic waste discharge	CI	
63. Rinse the drum with respective solvent to dissolve the residual technical and recycle the collected material in formulation.	Imp	Nil	NQ	NQ	Reduced toxic waste discharge	Not needed	
64. Collection and selling of leaky/damaged aluminium containers for recycling	Imp	Nil	Rs. 2,000	NQ	Reduced solid and toxic waste	Imp. Being returned back to supplier	Containers for recycling should not be contaminated.

Bottom of Form 1

LEGEND:

NI	- Not Implemented
Impl	- Implemented
CI	- Continues to be Implemented
UI	- Under Implementation
NE	- Not Evolved during project
NQ	- Not Quantified

3.5

UNIT 1: SUPER INDUSTRIES PRIVATE LIMITED

During the Project, 56 Waste Minimization (WM) options were identified of which 20 were rejected mainly due to poor techno-economic feasibility as given in detailed worksheets. Of the remaining, 36 options at the end of the Project i.e. in December 1994, 16 were already implemented, 8 were under implementation and 12 were yet to be implemented.

The situation changed in the post-project period. All the 16 options, which were implemented earlier, continued to work. Further, of the options identified earlier, additional 10 options were implemented, 11 were not implemented and 19 options were rejected. It may be noted that even one of the rejected options was also implemented and is included above.

The most encouraging part was that the unit on its own identified and implemented fresh set of 6 WM options. In fact, the number of new options identified was higher but no details were available for those options, which were not implemented.

The total number of options, which were implemented as on December 1997, is therefore 32.

By December 1994, implementation of WM options required an investment of Rs.14,000 and resulted in a saving of Rs.228,000. This figure covers only 11 options. The implementation of 2 of the 6 newly identified options required an investment of Rs.53,000 and resulted in a saving of Rs.36,000. It may be noted that one of these two options has not given any monetary savings but was implemented due to resultant environmental benefits.

On the environmental front, there was no quantified data available on pollution reduction since most of the pollution is fugitive in nature. However in some cases (Options 42, 43, 38 and new Option 6), more than 50% reduction in toxic waste was achieved.

Financial Analysis of Options Implemented by Dec'94

Option No.	Investment	Saving
10	Nil	60,000
14	Nil	40,000
18	500	Nil
20	1500	Nil
22	Nil	4000
23	Nil	2000
25	Nil	100,000
35	12,000	NQ
38	Nil	16,000
42	Nil	4,400
43	Nil	2,200
	---	---
	14,000	228,600

Financial Analysis of New CP Options Implemented by Dec'97

New Option No.	investment	Saving
5	40,000	36,000
6	13,000	Nil
	53,000	36,000

Status of Implementation in Dec'97

Continued to be Implemented	=	16
Earlier Identified option Implemented	=	10
Earlier Identified option not implemented	=	11
Option rejected	=	19
		56
New Option identified implemented	=	6

NEW OPTIONS

1) Refer Item 16: The belt conveyor has been replaced with bucket elevator

2) Manual printing has been replaced by automatic filling thus avoiding spillage

3) Refer Item 29: At purchasing stage care is taken to order pre-segregated material.

4) Refer Item 33: In the new plant the changing is being done by enclosed conveyor belt

5) Manual changing of soap has been replaced by screw conveyor.

Reduced labour from 10 to 4. Saving of Rs.36,000/year. Time saving from 20 minutes for changing to 8 minutes. Reduced dust generation

Investment: Rs.40,000. Due to time saving, 10% increase in production.

6) In dust plant the pulverised powder from well is transferred directly by screw conveyor in the blender.

Investment Rs.13,000. Reduced entrainment of dust in the air by more than 50%

OVERVIEW OF THE PROGRESS IN IMPLEMENTATION OF THE WASTE MINIMIZATION OPTIONS DEVELOPED AS PART OF PROJECT DESIRE

(PESTICIDES FORMULATION SECTOR)

SUPER INDUSTRIES LTD.

{PRIVATE}Description of the Waste Minimization Option	Implementation Status as on Dec'94	Economic benefits (only for Implemented options		Environmental benefits (only for implemented options		Implementation Status as on Dec'97	Remarks/comments
		Investment Cost	Net annual savings	Quantitative	Qualitative		
A.. GRANULE FORMULATION PLANT							
1. Periodic checking and repair of technical transfer valve from drum to common header.	Imp	Nil	NQ	NQ	Reduced exposure of to toxic fumes	CI	-
2. Extraction of fumes from generation/discharge points of blender.	To be Imp	NQ	NQ	NQ	Improved shop air quality	Not Imp.	Awaiting clearance from UPL – Major Client
3. Scrubbing the Phorate from the extracted fumes (blender).	To be Imp	NQ	NQ	NQ	Reduced emission discharge	Not Imp	- do -

4. Extraction of fugitive emissions and discharge into the atmosphere. (blender charge hopper)	To be Imp	NQ	NQ	NQ	Improved shop air quality	Not Imp	- do -
5.Scrubbing of toxic pollutants from extracted stream (of 4)	To be Imp	NQ	NQ	NQ	Reduced emission discharge	To be Imp	- do -
6. Periodic repair and replacement of worn out sealings/gaskets of valve.	Imp	Nil	NQ	NQ	Better shop air quality	CI	
7. Extracting the generated fume and discharging the same above roof. (from mixer)	To be Imp	NQ	NQ	NQ	Better shop air quality	To be Imp.	- do – (same as 3,4,5)
8. Replace atleast once in day, the nozzle set with cleaned nozzles and clean chocked nozzles.	UI	NIL	NIL	NQ	NQ	Imp Twice/Week	
9. Extraction of fumes and discharge into the atmosphere. (from spray container)	To be Imp	NQ	NQ	NQ	Better shop air quality	To be Imp	- do – (same as 3,4,5)
10. Usage of better quality of gunny bags for the storage of granules.	Imp	NIL	@ Rs 1700/T Rs 60,000	3T/ month of reduced loss	Reduced solid waste	CI	

11. Volumetric weighting and mechanical (pumping) charging of technical in close loop system.	Reject	-	-	-	-	Reject	Tech. And economically not viable
12. Storage of granules in silo, volumetric weighing and mechanical transfer to charge hopper.l	Reject	-	-	-	-	Imp	(Economically not viable) In the new plant bucket elevator has been installed
13. Optimise no. of nozzles			NQ	NQ	NQ	CI	
14. A pump holder with a tray for keeping the transfer pipe with valve after its use	UI	NIL	2 litres/day of phorate @ Rs. 200/litre Rs. 40,000	Technical (Phorate) recovered	Drastic reduction in fume generation	Imp	
15. Closing all the openings during blending.	Reject	-	-	-	-	Reject	Tech. Not feasible
16. Reducing inclination of the belt conveyor.	Reject	-	-	-	-	Reject	Economically Not viable
17. Installation of a simple bag clamping arrangement along with laminar plates at blender discharge	Reject	-	-	-	-	Reject	Tech. Not feasible
18. Changing the physical arrangement of technical charging.	Imp	Rs. 500	NQ	NQ	Reduced exposure of workers	CI	The tank has been made underground

19. Installing a Doctor's Knife at the belt discharge point.	UI	NQ	NQ	NQ	Better shop air quality	Not Imp	Not required any more due to new option No.1
20. Placement of a tray beneath the mixer to collect the spilled material and recycle the same.	Imp	Rs. 1,500	NQ	NQ	Better shop air quality	CI	
21. Recovering the phorate from the scrubbed liquor (of 3)	Reject	-	-	-	-	Reject	Economically Not viable
22. Recovery of the residual technical material by keeping the drum in inverted position for some time.	Imp	Nil	0.2 litres/day @ Rs.200/litre =Rs.4,000	Toxic waste reduced by 20 kg/yr	-	CI	
23. Rinsing of the drum with suitable solvent and recycle the collected material in formulation.	UI	Nil	Approx. Rs. 2,000	Toxic Waste reduction by 10 kg/yr	-	Imp	
24. Recovery of dust and chemicals from extracted stream (of 5)	Reject	-	-	-	-	Reject	Economically Not viable
25. Controlled recycle of waste in formulation.	Imp	Nil	Rs.100,000	2-3 ton (1Ton/batch) of reduced waste	-	CI	

B. DUST/WETTABLE POWDER PLANT							
26. Periodic checking and repair (replacement of torn sealings etc.) of technical transfer valve from drum to common header.	Imp	Nil	NQ	NQ	Reduced fugitive emission	CI	
27. Sealing of all openings of blender to prevent fugitive emissions.	Imp	NQ	NQ	NQ	Reduced fugitive dust emission	CI	
28. Usage of industrial vacuum cleaner for shop floor cleaning.	To be Imp	NQ	NQ	NQ	Better cleaning	To be Imp	
29. Manual segregation of smaller size (acceptable in pulveriser) and bigger size soap stone lump	Reject	-	-	-	-	Reject	Technically & Economically Not viable
30. Pneumatic charging of soap stone and closing charge hopper to avoid spillages and fugitive emission.	Reject	-	-	-	-	Reject	Economically Not viable
31. Mechanical handling and volumetric weighing of technical	Reject	-	-	-	-	Reject	Technically & Economically Not viable

32. Enclosing the jaw crusher and installation of dust suppression system with water spray.	Reject	-	-	-	-	Reject	Tech not viable
33. Charging by enclosed conveyor belt and closing the charging hopper.	Reject	-	-	-	-	Reject	Economically not viable
34. Installation of premixer.	Reject	-	-	-	-	Reject	Economically not viable
35. Installation of rotary air lock valve.	UI	Rs.12,000	NQ	NQ	Reduced dust generation	Imp.	Imp.in new plant
36. Removal of the recirculation line (from the cyclone outlet to the inlet of Impex pulveriser) and putting the entire stream into a bag house.	Reject	-	-	-	-	Reject	Economically not viable
37. Close All openings of the blender and make a vent pipe attached with a small bag filter	Reject	-	-	-	-	Reject	Technically Not feasible
38. Recycling the fine dust collected in bag house.	Imp	Nil	Rs.16,000	2% dust recycling for production of 4000 tons/year. Reduction is 99%		CI	

39.Extraction of fugitive dust emission and subsequent collection and recycle.	To be Imp	NQ	NQ	NQ	Better shop air quality	To be Imp	
40. Charging of contaminated solvent used in cleaning of transfer pump to blender.	Imp	NQ	NQ	NQ	Reduced toxic waste	CI	
41. Cleaning of spray nozzles and charging of solvent (if it is used) to the blender.	To be Imp	Nil	NQ	NQ	Reduced toxic waste dis-charge	Imp. (Twice/week)	
42. Recovery of the residual technical material by keeping the drum in inverted position for some time.	Imp	Nil	100 gms./day @ Rs. 220/Kg = Rs 4400	Toxic wasted reduced by 20 Kg/yr (50% reduction)	Reduced toxic waste discharge	CI	
43..Rinsing of the drum with suitable solvent and recycle the collected material in formulation, EC formulation or sell it to other formulators.	UI	NIL	50 gm/day @ Rs. 220/Kg = Rs. 2200/Yr	Toxic waste reduced 10 Kg/yr (50% reduction)	Reduced toxic waste discharge	Imp	

C. LIQUID FORMULATION PLANT							
44. Periodic repair, replacement of washers and gaskets of transfer pumps, flanges and valves in transfer line to avoid leakages	Imp	NIL	NQ	NQ	Better shop air quality	CI	
45. Closing of all openings of blender	Reject	NQ	NQ	NQ	Better shop air quality	Reject	
46. Extraction of fumes at generation/discharge points	To be Imp	NQ	NQ	NQ	Better shop air quality	To be Imp	
47. A pump holder with a tray should be made for keeping the hand pump after its use.	UI	NQ	NQ	NQ	Better shop air quality	To be Imp	
48. Volumetric weighing and mechanical (pumping) charging in close loop system	Reject	-	-	-	Reject	Tech. And economically not viable	
49.Pneumatic charging of solid material	Reject	-	-	-	Reject	Economically not viable	
50.Placing the packed bottle/containers over a big tray for recovering the waste from leaking ones	Reject	-	-	-	Reject	Economically not viable	

51.100% leak testing of containers/bottles before filling with the product	Reject	-	-	-	Reject	Economically not viable	
52. The drum opening can be closed by providing a loosely fitting (to maintain pressure balance while pumping) cork through which the transfer pipe should be inserted	UI	NIL	NQ	NQ	Better shop air quality	Imp	
53.Avoid using open top containers. The open top container can be closed with an appropriately designed cover	To be Imo	NIL	NQ	NQ	Better shop air quality	Imp. No more open top containers being used	
54. Recover the technical material by keeping it in inverted position for some time	I.np	Nil	Included in 42	Included in 42	Reduced toxic waste discharge	CI	
55. Use the cleaning solvent 3-4 times and then dispose it off	Imp	NIL	NQ	NQ	Reduced toxi waste discharge	CI	
56. Rinse the drum with respective solvent to dissolve the residual technical and recycle the collected material in new formulation	To be Imp	Nil	Included in 43	Included in 43	Reduced toxic waste discharge	Imp	

4. Dissemination Activities after Project DESIRE in Pulp & Paper and Textile Dyeing Sectors

WM Progress outside demonstration units

The assessment of Waste Minimisation uptake in companies outside the DESIRE demonstration units as assessed by Corporate Insight, has been divided into three parts, respectively:

1. *Descriptive assessment of WM dissemination activities*: The total effort of dissemination activities is described and analysed, in each of the two sectors involved in DESIRE and in the Surat and Muzzafarnagar regions in which the operating demonstration units are located. Unfortunately, the demonstration units in Ahmedabad for textile-dyeing & printing and in Delhi for Pulp & Paper sector have closed down due to the orders of the Supreme Court of India and therefore, these regions could not be studied.

2. *Waste Minimisation uptake in companies participating or contacted in WM dissemination activities*: the attitudes and perception regarding Waste Minimisation in companies involved in the dissemination activities have been surveyed. Also, the current uptake of a number of generally feasible Waste Minimisation options in those companies has been evaluated.

3. *Dynamics of the current dissemination system*: the differences of the uptake of Waste Minimisation are analysed on the basis of development stages in the dissemination system, for this purpose defined as a client/provider system.

4.1. Dissemination activities

4.1.1 Description of dissemination activities

As part of Objective five of the Desire project, three industry-specific workshops and a national seminar were organised to start the dissemination of the experiences of the project. The need for a properly planned dissemination strategy was stressed in the Desire final report. Next to the final report and general manual, sector-specific manuals were developed.

An important mechanism that was developed independently by **NPC** after **DESIRE**, but using the experiences and results of the demonstration project as input, was the establishment of **Waste Minimisation Circles (WMC)** in particular regions.

The influence of DESIRE project on the other dissemination activities is not always obvious and explicit; for instance the influence of DESIRE on WMC. Therefore, a description of related issues going on in the targeted sectors have been made and the relation to DESIRE has been assessed.

A description of the network that actually performed and continues to perform the dissemination activities has been provided.

The information on the following was gathered:

Activities undertaken

- What activities were and are being undertaken (for each of the two sectors) in the dissemination process following project DESIRE
  - Training workshops
  - Waste Minimisation Circles
  - Publications
  - Information materials
  - Others
- What was, in brief, the content of each of the activities
- What were the objectives of the activities
- How was the target group selected
- What was the exact relation to DESIRE

Total number of companies contacted

- Participants in dissemination training workshops
- Informed industrial actors as in Waste Minimisation Circles

For those two groups: what was the estimated non-response percentage (targeted and approached, but not participating)?

- Other industrial actors - informed in other ways
- Estimated number of companies informed in other ways (reports, articles)

Other related activities undertaken in industry

Other related activities were undertaken in the same sector that has a clear relation to the Waste Minimisation approach.

Network Description

The specific activities and the role of the following network actors in the dissemination programme were examined in brief:

- NCPC
- NPC
- Industry Associations (national and regional)
- Consultants
- Government (State & Centre)
- Environmental Agencies

NCPC National Cleaner Production Centre India

Set up in July '95, the NCPC India is hosted by the National Productivity Council and is established under the UNIDO/UNEP programme. NPC was considered along with four other organisations for hosting NCPC, but was preferred over others because of the insight and experiences gained in Project DESIRE.

Mission

To encourage, promote and establish Cleaner Production techniques and technologies especially in Small & Medium Industrial Enterprises to ensure sustainable industrial development.

Objectives

- Demonstrate CP concepts in Indian industries particularly Small Scale Industries
- Conduct demonstration projects
- Conduct training programmes/workshops
- Disseminate information on Cleaner Production
- Policy level intervention

The following activities are being performed by NCPC to achieve the above objectives:

1. Awareness Workshops (No. of Participants) (1032)

2. Training (No. of persons trained)
   - Basic Appreciation Training (249)
   - In Company Training (647)
   - Advance training for Professionals (65)
   - Training of Trainers
   - Training of Government officials and Regulatory authorities

1. Demonstration Projects (19 of which 9 have been completed)

   - In Textile Hosiery Sector in 5 units at three locations; Ludhiana, Tiruppur and Kanpur

   - In Dye & Intermediates Manufacturing sector at 4 units at Gujarat & Maharashtra

   - In the Electroplating sector 5 units have been selected in Karnataka

2. Regional Cleaner Production Centres at the State level

   Two states Karnataka & Gujarat have formed regional CP Centres with help from their respective State governments and technical assistance from NCPC. A third Regional CP Centre is being proposed in Punjab

3. Consultants Trained by NCPC

So far 65 consultants have been trained by NCPC in cleaner production. Some of these consultants are also co-ordinating Demonstration units. Of these, three demonstration units are in Pulp & Paper Sector and two in the Plywood sector.

4. Policy Study

   It is in progress at the moment.

NCPC has also published 3 Newsletters, 5 Publications and has featured in a Video film telecast on National TV.

NPC Environment Division

The Environment Division of National Productivity Council is the nodal agency for the Waste Minimisation Circles programme which has been sponsored under the project "Waste Minimisation in Small & Medium Scale Industries (SMIs)" by the Ministry of Environment & Forests, Government of India and funded by the World Bank.

Mission

To inculcate the culture of Waste Minimisation in SMIs across the country to make them more productive and also protect the environment.

Objectives

The two broad objectives were:

- Development of a communication Strategy for launching Awareness Campaign on Waste Minimisation
- Establishment and Running of 100 Waste Minimisation Circles (WMCs) in the SSIs in the country.

Activities

The first objective of Development of a communication Strategy for launching Awareness Campaign on Waste Minimisation was launched through the preparation of a plan for selection of Media consultants and a strategy for launch of the awareness campaign.

The second objective of establishment and running of 100 WMCs was launched in 1995 and the concept has evolved from the Quality Circles as also the Waste Minimisation Group. WMC is a small group (3 -5) of willing entrepreneurs who make similar products and have similar processes/ inputs and operate in the vicinity. They meet at a fixed frequency, preferably at one of the participating units and use Waste Minimisation Techniques to improve their productivity and protect their environment. Their functioning is facilitated by a trained facilitator and technical inputs supplemented by NPC.

To achieve these objectives NPC Environment Division has so far completed the following activities:

CORPORATE INSIGHT
Review Pulp & Paper and Textile Dyeing & Printing

1. Running WMCs facilitated by NPC personnel	15 circles facilitated in Phase I during '95-'97
2. Training of WMC Facilitators	4 such workshops have trained over 80 facilitators
3. Running WMCs facilitated by consultants trained & supervised by NPC	23 Circles have been initiated

4. The following sectors have been covered
   - Pulp & Paper
   - Hotels & Restaurants
   - Textile Dyeing & Printing
   - Textile Hosiery
   - Textile Weaving
   - Leather Tanning
   - Textile Dyes & Intermediates Manufacture
   - Electroplating
   - Bulk Drugs & Intermediates Manufacture
   - Plywood Manufacture
   - Pesticide Formulators
   - Printed Circuit Boards Manufacture
   - Metal Finishing

5. News letter on WMCs

So far 4 newsletters have been published

Industry Associations (National & Regional)

CII, an apex body of the Industry at the National level has through its Environment Management Division launched the initiative for Waste Minimisation at the national level for the Large sector with special focus on the Refineries sector.

The Southern India Textile Processors Association (**SITPA**) at Erode and the Tiruppur Exporters Association collaborated to run the Awareness & Review Workshops for the Textile Weaving sector and the Textile hosiery sector at Tiruppur .

The Indian Agro Pulp & Paper Manufacturers Association's role in Waste Minimisation has already been analysed in the Industry Sector: Pulp & Paper.

Consultants

The role of consultants has already been covered in the above sections on the two Industry Sectors as well as the activities of NPC and NCPC.

Government (State & Centre) and Environmental Agencies

Similarly, the role of State and Central Governments as well as the respective Environmental Agencies in Dissemination activities has been covered in the above sections on the two Industry Sectors as well as the activities of NPC and NCPC

4.2. *Assessment actual implementation of Waste Minimisation*

On the basis of the descriptive data of part 4.1, an assessment was made of the progress in uptake of the perception of company management and change in attitude and behaviour towards Waste Minimisation, and of the actual implementation of Waste Minimisation solutions in companies other than the DESIRE demonstration units.

a. Survey on perception, attitude and behaviour

To assess the influence of Desire on the perception, attitude and behaviour towards Waste Minimisation in non-demonstration companies, a brief survey was conducted among a selection of companies that have been involved in any way in the dissemination activities following DESIRE.

The target group for this survey can be divided into two segments: WMC participants, dissemination workshop participants and other firms in the same region as the demo-units. A representative sample was taken for each group.
All companies in these segments were only chosen from the designated industry sectors (P&P and textile).

The following questions were asked (as in table XI):

Table XI: Company survey on Perception, Attitude and Behaviour

• Did you value the information on Waste Minimisation that you received? • Did this improve your awareness on Waste Minimisation? • Was the information potentially useful for your company?	If 2 or 3 'yes': Positive effect on awareness on Waste Minimisation
• Did you see possibilities for Waste Minimisation in your company afterwards? • Did your vision on materials use, wastes and emissions, processes in your company changed because of the information?	If 1 or 2 'yes': Positive effect on attitude towards Waste Minimisation
• Did you actually undertake actions to start a Waste Minimisation approach? • Did you actually implement one or more Waste Minimisation measures (see below for list)? • Did you continue with new Waste Minimisation activities after the first results?	If first 'yes': small change in behaviour If 'yes' also to second: considerable change If 3 'yes': big change in behaviour.

On the basis of this survey, it was estimated that what part of the companies that were included in direct WM dissemination activities actually changed their awareness, attitude and behaviour towards Waste Minimisation.

Unavoidable, to a certain extent, the results of the survey described above are subjective, since they mainly reflect the opinion of the managers of their own attitude and behaviour. Therefore, a more objective survey on the actual implementation of a number of Waste Minimisation options was performed with the representative group.

3 Units from the Pulp & Paper Sector and 8 units from the Textile Dyeing & Printing Sector were included for this survey.

The assessment of the uptake of Waste Minimisation in other companies in the same sector was based, at least partially on the level to which more or less generally feasible Waste Minimisation options have been implemented.

The following tables XII and XIII provide lists of such generally feasible options for respectively pulp and paper and textile dyeing and printing industries. The options are grouped in five categories; each category encompasses highly alike Waste Minimisation options.

One might view the options in the same categories as different ways of implementing the same Waste Minimisation approach; each customised to specific circumstances in different units in the same industry sector. It is assumed that in case a company has implemented options from at least 3 of the five categories the company has undertaken a deliberate effort to implement Waste Minimisation

b. Implementation of generally feasible Waste Minimisation options

Table XII: Generally applicable Waste Minimisation options for pulp and paper industry.

Category/Waste Minimisation Approach	*Examples of generally feasible Waste Minimisation options in respective category*
insulation of hot process equipment, steam and condensate pipes, etc.	insulation of steam pipes and traps, and condensate pipes and tanks insulation of digesters insulation of drum ends in paper machine drying section
proper raw material preparation	improved incoming material control in order to avoid excessive levels of chaff, leaves, dust, or moisture improvement of the (dry) dedusting system (for straw) improvement of the raw material cutting system (for bagasse, elephant grass, etc.) installation of depither (for bagasse)
segregation of initial black liquor	modified operating practices for pouch washer in order segregate some black liquor for direct reuse prior to adding washing water installation of improved black liquor segregation/pulp washing systems (screw press, wire press, etc.)
water conservation	self closing valves on water taps repair of leaks water efficient nozzles for belt washing on paper machines white water recovery and reuse
fibre recovery	avoidance of overflows in wire/couch pit optimisation of side cutting on paper machine installation of fibre recovery system for white water

Implementation of generally feasible Waste Minimisation options

Table XIII: Generally applicable Waste Minimisation options for textile dyeing and printing industry.

Category/Waste Minimisation Approach	*Examples of generally feasible Waste Minimisation options in respective category*
insulation of hot process equipment, steam and condensate pipes, etc.	insulation of steam pipes and traps, and condensate pipes and tanks insulation of (jet) dyeing equipment, stenters and drying ends of printing machines
reuse of spent process baths	storage and direct reuse of spent dyeing baths (disperse dyeing)
standardisation of dyeing/printing recipes and minimisation of colour stock	reduction of the number of colours in stock for each class of dyestuffs (preferably to less than 10) standardisation of the preparation of dyeing recipes and shade matching (including maintenance of database of dyeing recipes) experimentation with the reduction of auxiliaries (salts, levellers, etc.) in dyeing recipes
water conservation	self closing valves on water taps repair of leaks reuse of cooling water as process water counter current use of washing water installation of low liquor (jet) dyeing equipment
print paste recovery and reuse	installation of doctor blade for recovery of residual print past from printing machine improved production planning in order to minimise print paste remnants at the end of printing jobs use of proper utensils to empty screens and other parts of printing equipment, prior to equipment cleaning at change of design/colours

4.3. *Analysis of dissemination as dynamic client-provider*

The dissemination programme for Waste Minimisation that followed the Desire project is relatively recently started. It can therefore be expected that the phases differ in which the dissemination efforts with different companies are taking place: some contacts are new, others more mature. If this is not taken into account in the assessment given above, the results could seem more negative then they really are.

The results measured at this particular moment must therefore be set in the context of the dynamic development from the start of the dissemination effort, until the continued involvement of a company with Waste Minimisation.

Analysing the dissemination efforts as a client-provider system can best do this. The companies are the client, the network (described above in II.1) delivering the Waste Minimisation information and expertise are the suppliers.

In this system, the suppliers will have the objective to first create interest in Waste Minimisation and the approaches and 'products' offered by them. This interest should turn into actual first use of Waste Minimisation approaches and 'purchase' of the products offered. Ultimate goal is that the Waste Minimisation approach is integrated in the company, and contacts with the suppliers are frequent and interactive.

So, in such a relation, four stages can be postulated:

1. Ignorance of the company towards Waste Minimisation

2. Interest in the approach

3. Initiation of the first activities

4. Complete involvement/integration of the approach in the companies' activities

Clearly, this process can take some time to develop. Therefore, it has to be assessed what part of the companies is in what stage of the relation: for each of the company categories an estimate is made of the division between the different stages (10-20-30% etc.) (Table XIV)

Table XIV: Relative division over Relationship stages within company categories

Stage *Category:*	*Ignorance*	*Interest*	*Initiation*	*Involvement/ Integration*
Workshop participants	(%)			
Waste Minimisation circle participants				
Other companies in region				
Not informed companies (rough estimate)				

On the basis of this assessment, a better picture can be obtained on the actual stage that most of the companies are in, and can supply some amendments to the results of the evaluation in II.2.

A second aspect of the dynamic approach is that; to push forward the number of companies to the later stages, different tactics have to be applied at each stage. To be able to develop further the interactive approach needed for this, a brief survey was undertaken within a selected group of the companies that are known to be in a certain phase, and following questions were asked:

- What benefits do you perceive for your company if applying Waste Minimisation?
- What information/services do you require for your next steps in the Waste Minimisation approach?
- What do your think are the strongest points of the Waste Minimisation approach?
- What do you think are the main weaknesses from the Waste Minimisation approach?
- What requirements do you need from the supplier of Waste Minimisation information and services?

The results of the survey are summarised in the table XV below

Variables for consideration:	*Companies at stage:*	*Description*
Benefits perceived	Interest	
	Initiation	
	Integration	
Range Info/Services offered/accepted	Interest	
	Initiation	
	Integration	
Perceived Strength/weaknesses of Waste Minimisation	Interest	
	Initiation	
	Integration	
Desired Relationship	Interest	
	Initiation	
	Integration	

Table XV: Description of variables for consideration on improved Waste Minimisation uptake

Descriptive assessment of WM dissemination activities

Sector: Pulp & Paper Sector

Cluster: Muzzafarnagar

Industry Profile

No. Of Units in the Cluster:	34
No. Of Units operating on date:	28
No. Of Units using Agro-residue Based raw material:	20
Vehicles of Dissemination:	WMC /Awareness Workshop by Industry Association (IAPMA)
No. of units participated in WMC Awareness Workshops:	09
No. of units participated in the IAPMA Awareness Workshop:	16
No. of units surveyed for Perception, Attitude & Behaviour survey:	03
No. of units surveyed for Implementation of generally feasible Waste Minimisation Options:	03

Waste Minimisation uptake in companies participating or contacted in WM dissemination activities

The following units were surveyed for the Perception, Attitude and Behaviour Survey as well as for Implementation of generally Feasible Waste Minimisation Options:

S.No.	*Name of Unit*	*Place*	*Person Contacted*
1.	Garg Duplex (P) Ltd.	Muzaffarnagar	Mr. Rajesh Jain
2.	Silverton	Muzaffarnagar	Mr. Deepak Goyal
3.	Maya Duplex	Muzaffarnagar	Mr. Rajeev Goel

a. Results of the Perception, Attitude and Behaviour Survey

33% units showed Big Change in Behaviour;
33% units showed Considerable Change in Behaviour;
33% units showed Small Change in Behaviour after being exposed to Waste Minimisation

b. Implementation of generally feasible Waste Minimisation options for pulp and paper industry

Category/Waste Minimisation Approach	*Implementation Status of generally feasible Waste Minimisation optionsin respective category*	*% Imp.*
insulation of hot process equipment, steam and condensate pipes, etc.	• insulation of steam pipes, traps and condensate pipes and tanks • insulation of digesters • insulation of drum ends in paper machine drying section	66% 66% 33%

Category/Waste Minimisation Approach	*Implementation Status of generally feasible Waste Minimisation optionsin respective category*	% ...ip.
segregation of initial black liquor	• modified operating practices for pouch washer in order segregate some black liquor for direct reuse prior to adding washing water	33%
	• installation of improved black liquor segregation/pulp washing systems (screw press, wire press, etc.)	0%
water conservation	• self closing valves on water taps	33%
	• repair of leaks	100%
	• water efficient nozzles for belt washing on paper machines	100%
	• white water recovery and reuse	100%
fibre recovery	• avoidance of overflows in wire /couch pit	33%
	• optimisation of side cutting on paper machine	66%
	• installation of fibre recovery system for white water	66%

In addition to the above these units affected savings in Rosin Consumption upto 50%; Alum reduction by 50% and Caustic Soda consumption by 10%.

One unit has also installed a High Efficiency Industrial Boiler which uses Pith from the Depither.

Results of the Generally Feasible Options Implementation Survey

Results of the Survey showed that 2 out of the 3 units surveyed had made a Deliberate Attempt to Implement Waste Minimisation Options.

A brief survey was undertaken within the selected group of the companies that are known to be in a certain phase, and following questions were asked:

- What benefits do you perceive for your company if applying Waste Minimisation?
- What information/services do you require for your next steps in the Waste Minimisation approach?
- What do your think are the strongest points of the Waste Minimisation approach?
- What do you think are the main weaknesses from the Waste Minimisation approach?
- What requirements do you need from the supplier of Waste Minimisation information and services?

The results of the survey are summarised in the table below

Variables for consideration:	*Companies at stage:*	*Description*
Benefits perceived	Interest	Is very useful
	Initiation	Savings in Raw Material & Water
	Integration	Use for all by products
Range Info/Services offered/accepted	Interest	WMCs
	Initiation	Join WMCs
	Integration	Be a Demonstration Unit
Perceived Strength/weaknesses of Waste Minimisation	Interest	Unable to provide reliable breakthrough for Black Liquor segregation
	Initiation	Unable to separate Sand Fines
	Integration	Working as WM facilitator
Desired Relationship	Interest	Constant Help in implementation of WM
	Initiation	Provide Pulp & Paper Experts
	Integration	To be able to provide breakthrough to the clients

Waste Minimisation Circles

After completion of Project Desire the demonstration unit in the vicinity; **Bindlas Duplex (P) Ltd**. took initiative in sharing its achievements with other units through establishment of the first **WM Circle** facilitated by NPC in July 1995. There were six participants in the awareness workshop but three units dropped out, as they were reluctant to share their respective plants' information. This circle was closed in July 1996. The circle members M/s Bindlas Duplex (P) Ltd., Garg Duplex (P) Ltd and Silverton are still maintaining informal contact.

In April '98 a new circle has been started by Mr. Pankaj Agarwal who has been trained as a Waste Minimisation Circles Facilitator. There are three participants in this Circle.

Demonstration Project

One project is being run with the help of NCPC at Menu Paper Mills (P) Ltd. at Muzaffarnagar.

Training Programme on Waste Minimisation & Environmental Improvement in Pulp & Paper Sector

The Indian Agro Paper Mills Association (IAPMA) and sponsors, Ministry of Environment & Forests, Govt. of India also organised a three-day workshop in this region, which was attended by 16 units. Of this, 09 were already informed through the WMC awareness workshops, while 07 were new entrants.

Stage Category:	Ignorance	Interest	Initiation	Involvement/ Integration
Workshop participants	0%	55%	25%	20%
Waste Minimisation circle participants	0%	0%	67%	33%
Other companies in region	0%	100%	0%	0%
Not informed companies (rough estimate)	20%	0%	0%	0%

Dissemination activities outside the Region in Pulp & Paper Sector

The major players in dissemination activities outside the Muzzafarnagar Cluster and their activities are summarised below:

Waste Minimisation Circles

One circle facilitated by a Private Consultant has been formed in Modinagar in May 1998 and has three participants. The Awareness Workshop has already been conducted for them. Another circle has being formed by another Private consultant at Chandigarh. All these participants are at Interest Stage.

Demonstration Projects

Accredited consultants and NCPC are running two demonstration projects.
These are at:

1. Rama Pulp & Paper, Bijnore (UP)
2. Shakumbri Straw Products, Moradabad (UP)

Mr. S K Chaudhary, an accredited facilitator for Waste minimisation under the guidance of NCPC, is facilitating these demonstration projects.

Other Activities

Training Programme on Waste Minimisation & Environmental Improvement in Pulp & Paper Sector

A three-day workshop facilitated by Indian Agro Paper Mills' Association and sponsored by Ministry of Environment & Forests, Govt. of India was conducted at two locations:

Aurangabad where 25 units participated and Chandigarh where 20 units participated

Stage Category:	Ignorance	Interest	Initiation	Involvement/ Integration
Workshop participants	0%	100%	NA	NA
Waste Minimisation circle participants	NA	7%	00	00
Other companies in region	NA	NA	NA	NA
Not informed companies (rough estimate)	NA	NA	NA	NA

NA: Not Able to Assess

National Workshops on Cleaner Production in Pulp & Paper Mills

National Workshops on Cleaner Production in Pulp & Paper Mills were also conducted by Central Pollution Control Board to share the benefits of the **NHEM** & **UNEP** sponsored Programme on Demonstration of Cleaner Production in Pulp & Paper Mills in April 1997 at Hyderabad and Delhi and attended by over 200 participants though not necessarily from the Small or Medium sectors.

The NIEM initiative was started in India in 1987. The NIEM Phase III programme envisaged Promotion of Cleaner Production in Pulp & Paper mills in India. Four units were selected for promotion & demonstration of CP. The Sectoral Manual on Agro based Pulp & Paper Sector was used by the participants to identify CP options and implement them.

Descriptive assessment of WM dissemination activities:

Sector: Textile Dyeing & Printing Sector

Cluster: Surat (City, Pandesra & Sachin Industrial Areas)

Industry Profile

No. of Units in the Cluster:	300
No. of Units operating on date:	250
Vehicles of Dissemination:	WMC /WMG/Awareness Workshops by Industry Association -SGCCI & State Pollution Control Board -GPCB
No. of units participated in WMC Awareness Workshops:	25
No. of units participated in the WMG Workshops/Meetings:	16
No. of units participated in other related activities like ISO 14000 Awareness:	100
No. of units participating in Demonstration for ISO 14000:	01
No. of units surveyed for Perception, Attitude & Behaviour survey:	08
No. of units surveyed for Implementation of generally feasible Waste Minimisation Options:	08

II.1 Waste Minimisation uptake in companies participating or contacted in WM dissemination activities

The following units were surveyed for the Perception, Attitude and Behaviour Survey as well as for Implementation of generally Feasible Waste Minimisation Options:

S.No.	*Name of Unit*	*Place*	*Person Met*
1.	Randhir Dyeing & Printing Mills	Surat	Mr. Randhir Jariwala
2.	Bhagwati Dyeing	Surat	Mr. Vipul Dakoria
3.	Rachna Dyeing	Surat	Mr. Sanjay Agarwal
4.	Aggarwal Textile Mills	Surat	Mr. Binay Aggarwal
5.	Manila Textiles	Sachin	Mr. Manoj Lungiwala
6.	Himsons	Surat	Mr. Rakesh S Bachkaniwala
7.	Hichoice	Sachin	Mr. Manoj
8.	Luthra Dyeing & Printing	Pandesara	Mr. Girish Luthra

Only those units influenced by Project DESIRE were taken up for this survey

II.2a Results of the Perception, Attitude and Behaviour Survey

50% units showed Big Change in Behaviour;
25% units showed Considerable Change in Behaviour;
25% units showed Small Change in Behaviour after being exposed to Waste Minimisation

II.2b Implementation of generally Feasible Waste Minimisation Options

Category/Waste Minimisation Approach	*Implementation of generally feasible Waste Minimisation options in respective category*	*%*
insulation of hot process equipment, steam and condensate pipes, etc.	• insulation of steam pipes and traps, and condensate pipes and tanks • insulation of (jet) dyeing equipment • stenters and drying ends of printing machines	63% 0% 50%
reuse of spent process baths	• storage and direct reuse of spent dyeing baths (disperse dyeing)	37%
standardisation of dyeing/printing recipes and minimisation of colour stock	• reduction of the number of colours in stock for class of dyestuffs • standardisation of the preparation of dyeing recipes and shade matching (including maint. of database of dyeing recipes) • experimentation with the reduction of auxiliaries (salts, levellers, etc.) in dyeing recipes	63% 50% 37%

Category/Waste Minimisation Approach	*Implementation of generally feasible Waste Minimisation options in respective category*	%
water conservation	• self closing valves on water taps	0%
	• repair of leaks	
	• reuse of cooling water as process water	37%
	• counter current use of washing water	100%
	• installation of low liquor (jet) dyeing equipment	50%
		50%
print paste recovery and reuse	• installation of doctor blade for recovery of residual print past from printing machine	63%
	• improved production planning in order to minimise print paste remnants at the end of printing jobs	37%
	• use of proper utensils to empty screens and other parts of printing equipment, prior to equipment cleaning at change of design/colours	37%

Seven out of the eight units surveyed had converted to Gas Fired Boilers and all the units had conserved Water after implementation of WM range from 30% to 90 % reduction in Water Consumption. 4 Units also started Intensive Electrical Energy Conservation Programmes in their units.

Insulation of Jet Dyeing Equipment was tried by two of the units but discontinued as this 'affects Cooling Cycle!'or 'the body developed cracks!'

Self-Closing valves have been discontinued as this option was not acceptable to the Workers.

Results of the Generally Feasible Options Implementation Survey

Results of the Survey showed that 5 out of the 8 units surveyed had made a Deliberate Attempt to Implement Waste Minimisation Options.

4.3. *Analysis of dissemination as dynamic client-provider*

Waste Minimisation Circles

After completion of Project Desire the demonstration unit in the vicinity; **Paradise Prints** took initiative in sharing its achievements with other units which was initially carried out through the WMG meetings and subsequently through establishment of the first **WM Circle** facilitated by NPC in 1995. There were 25 participants in the awareness workshop. Of this 06 have taken up WM seriously through the formation of a Circle.

Mr. Girish Luthra of Luthra Dyeing & Printing is the leader of this circle and Mr. Chittaranjan Desai of Paradise Prints, who is now an International Expert in Textile Dyeing & Printing sector is a member of this circle. Both of them have been instrumental in promoting Waste Minimisation through the Waste Minimisation Group, Surat and also bring out a newsletter at least twice a year.

Waste Minimisation Circles Awareness Workshops

Stage Category:	Ignorance	Interest	Initiation	Involvement/ Integration
Workshop participants	0%	60%	12%	28%
Waste Minimisation circle participants	0%	0%	67%	33%
Other companies in region	0%	100%	0%	0%
Not informed companies (rough estimate)*	60%	0%	0%	0%

* Percentage of total companies in the region that are Not Informed about Waste Minimisation

A brief survey was undertaken within the selected group of the 8 companies that are known to be in the Initiation and Integration phase, and following questions were asked:

- What benefits do you perceive for your company if applying Waste Minimisation?
- What information/services do you require for your next steps in the Waste Minimisation approach?
- What do your think are the strongest points of the Waste Minimisation approach?
- What do you think are the main weaknesses from the Waste Minimisation approach?
- What requirements do you need from the supplier of Waste Minimisation information and services?

The results of the survey are summarised in the table below

Variables for consideration:	Companies at stage:	Description: What they have to say
Benefits perceived	Interest	Very Useful for Water & Energy Conservation
	Initiation	Will help reduce BOD & COD loads
	Integration	Will make the units more efficient & Profitable
Range Info/Services offered/accepted	Interest	Facilitation for WM Circles
	Initiation	Join WM Circles
	Integration	Be a Demonstration Project
Perceived Strength/weaknesses of Waste Minimisation	Interest	Have to Share Data with Competitors if in WMC
	Initiation	Does not give any breakthrough
	Integration	Inculcates a culture of Improvement
Desired Relationship	Interest	WM Circles must be formed
	Initiation	Support in Implementation
	Integration	Technological Improvements

Other Related Activities

Awareness Workshop on Environmental Management Systems

The **Waste Minimisation Group**, Surat (**WMG**); a voluntary body of Entrepreneurs, Academicians and Practising Managers and sponsors, **Gujarat Pollution Control Board (GPCB)** and **SGCCI (Southern Gujarat Chamber of Commerce & Industry)** organised a one day workshop on **Environmental Management Systems** for industries in this region which was attended by about 100 units. Mr. Chittaranjan Desai of Paradise Prints (A Demonstration Unit of Project Desire) made a presentation on his experiences of Waste Minimisation. Of the participants, majority of them was already informed of Waste Minimisation through the Project Desire Sectoral Workshop held at Surat in December 1994 & the awareness workshop of WMC.

Stage Category:	Ignorance	Interest	Initiation	Involvement/ Integration
Workshop participants	0%	94%	5%	1%
Waste Minimisation circle participants	0%	58%	25%	17%
Other companies in region	NA	NA	NA	NA
Not informed companies (rough estimate)	60%	NA	NA	NA

NA: Not able to assess

Dissemination activities outside the Region in Textile Dyeing & Printing Sector

There is not much activity outside Surat. Most of the units in Textile Dyeing & Printing Sector in Ahmedabad have been closed down. No discernible action in Waste Minimisation in this region is visible.

5. POLICY STUDY
FOR
PROMOTING CLEANER PRODUCTION
IN
INDIA

Prepared by: National Cleaner Production Centre
5-6, Institutional Area, Lodi Road
New Delhi - 110 003, India

POLICY STUDY ON CLEANER PRODUCTION IN INDIA

This policy study was commissioned by the National Cleaner Production Centre, India, with the purpose of identifying initiatives that can promote cleaner production in the Indian industry. The Terms of Reference lay down the scope of the study as follows:-

'The thrust of the study should be to examine the status of cleaner production in the existing frame work of environmental policies and to identify future initiatives for the promotion of C.P.' The terms of reference go on to add that the existing regulations should be studied and analysed to unearth provisions which encourage the use of Cleaner Production, and to suggest modifications to other clauses which are either CP neutral or which come in the way of wider use of Cleaner Production practices. This study is also expected to focus attention on market based and fiscal instruments, to search for ideas that can help greater acceptance of Cleaner Production. Resource pricing, institutionalisation of CP at the Government level and among industrial units, examination of the purchase policies of the government, the statutary scheme of environmental auditing, current educational policies, and how to bring about improvement in the awareness levels of politicians and bureaucrats, also have to be looked into as per the terms of reference of the assignment.

THE EXISTING FRAMEWORK

Environmental legislation in the country is based on the command and control philosophy. The first legislation on pollution control, The Water (Prevention and Control of Pollution) Act, was passed

in the year 1974. It set up a Central Pollution Control Board at the national level and State Pollution Control Boards in every state of the country. As per the Act, the main functions of the Central Pollution Control Board are to advise the Central Government, co-ordinate the activities of the state boards, collect, compile and publish technical data, lay down standards for a stream or a well, and plan and cause to be executed a nation-wide programme for the prevention, control or abatement of water pollution. The state Boards have to function almost on the same lines, at the state level. State boards also have the authority to establish and enforce effluent standards for factories discharging pollutants in to water bodies. Applications from factories are examined by the state boards before granting them consent to discharge. Water Act prohibits the working of any factory, with out obtaining a 'consent' from the State Pollution Control Board. They also survey and identify industrial sites for establishing new industrial units. The authority who approves such site plans are the State Governments. But the State Boards advise them on this matter.

As to the enforcement of the provisions of the Act, the State Boards have to file complaints in judicial courts against defaulting units. How ever in 1988, an amendment was made in the Act which invested strong executive powers in the Boards. As per the newly added provisions, the State Boards were authorised to even close down the units that pollute water bodies. The relevent section is quoted below:-

"33A. Power to give directions - Notwithstanding anything contained in any other law, but subject to the provisions of this act, and to any directions that the Central Government may give in this behalf, a Board may, in the exercise of its powers and performance of its functions under this Act, issue any directions in writing to any person, officer or

authority, and such person, officer or authority shall be bound to comply with such directions.

Explanation- For the avoidance of doubts, it is hereby declared that the power to issue directions under this section includes the power to direct-

(a) the closure, prohibition or regulation of any industry, operation or process, or

(b) the stoppage or regulation of supply of electricity, water or any other service."

The above provision drastically changed the legal powers of the Boards. Though it has not actually improved the effectiveness of the Boards, (we will see the reasons later) the amendments were incorporated with this purpose in mind. Till 1988, the Boards had no other option except filing a complaint against a defaulting unit in a court of law and patiently waiting for the final judgement which may get delivered after a few years. The units could then go in appeal against those verdicts, and continue polluting in the meanwhile. The 1988 amendments were intended to correct this deficiency by empowering the executive agencies with the authority to even close down factories. Of course they could resort to less coercive directions as well.

The second Environmental enactment to be legislated upon was the Water (Prevention and Control of Pollution) Cess Act. It was enacted in 1977 and it stands out different from the other enactments. All the other enactments follow the command and control pattern while this act provides economic disincentives against excessive use of water and encourages treatment of effluents. The Cess is collected by the State Pollution Control Boards and is deposited with the Central Government. Part of the proceeds goes to the State Boards to meet their administrative

expenses. In recent years the rate of cess has been enhanced to yield substantial revenues to the state boards. Consequently the effectiveness of its provisions also has improved.

The third pollution control law to appear in the Indian statute books, was the Air(Control and Prevention of Pollution) Act 1981. This Act deals with air pollution exactly in the same way as the Water Act deals with water pollution. The state boards are authorised to notify air pollution control areas and all industries operating in such areas are under statutary obligation to obtain 'consent' from the boards before they start operating. The state boards in consultation with the Central Board are to notify the standards in the states, where as the Central Board has the primary responsibility to fix air pollution standards at the national level. The State Boards can notify standards which are more stringent than the National Standards, but have no power to prescribe less severe ones.

As in the case of the Water Act, the Air Act also was amended in the year 1988 to empower the boards with the administrative powers which enable them to close down defaulting factories. A provision similar to Section 33A of the Water Act was incorporated in the Air Act also.

The most comprehensive legislation on pollution control was enacted in the year 1986. This was an unbrella legislation empowering the Central Government "to take all such measures as it deems necessary or expedient for the purpose of protecting and improving the quality of the environment and preventing, controlling and abating environmental pollution." The Environment Protection Act retains the administrative powers granted under the Air Act and the Water Act to close down factories in the Central Government, (this power has been deligated to the state governments) and

also authorises it to notify pollution standards. In these matters the Environment Protection Act does not grant any new tool for pollution control. The only additional subject dealt with by the Environment Protection Act is hazardous chemicals.

However the new teeth acquired by the Government under the Environment Protection Act is the authority to make rules in respect of all or any of the matters listed therein. The rules become enforcible after they are notified in the official gazatte and spares the Government the botheration of getting bills passed in the parliament on these subjects. The list includes the following matters.

(a) The standards of air, water or soil, for various areas and purposes.

(b) The maximum allowable concentration of various environmental pollutants,(including noise) for different areas.

(c) The procedures and safeguards for the handling of the hazardous substances.

(d) The prohibition and restrictions on the handling of hazardous substances in different areas.

(e) The prohibition and restrictions on the location of industries and the carrying on of processes and operations in different areas.

(f) The procedures and safeguards for the prevention of accidents which may cause environment pollution and for providing for remedial measures for such accidents.

The following are some of the rules notified under the above enabling provisions:

the equipments on a regular basis is very weak and undependable. The Board makes a surprise inspection only in cases where it receives complaints from the public.

There can be a permanent system for identifying the units which have pollution treatment facilities in working order, but which do not operate them on a regular basis. Some of the users of the water of the river can be given post cards with the address of the Pollution Control Boards printed on them, asking them to make a pencil mark on the card. If they are not satisfied with the quality of the water, they should mark the card with a red pencil and if they are satisfied it should be marked with ordinary black lead pencil. The respondents may be asked to sent daily post cards and should be supplied with enough number of pencils. In cases where there is continuous complaint, the Board should make surprise inspections.

In case it is found that the rural respondents are not behaving in a responsible manner, they can be given some special training for providing correct and useful information.

The steps that NCPC can initiate.

(1) Can concentrate on industrial units that are already following environmental norms on their own. Their list can be easily obtained from the State Pollution Control Boards, and these units can be persuaded to introduce, pollution prevention strategies. They will easily realise that pollution prevention is less expensive than the pollution treatment.

(2) The consultants and agencies that deal with Human Resource Development can be marshalled to lend a helping hand in the matter of the propagation of pollution prevention. In fact pollution prevention has

less to do with technologies or machines than with human attitudes. HRD people can try to inculcate the habit of innovativeness among the managers and workers for the prevention of wastes in all manufacturing processes.

(3) The effort should be to concentrate on the industries in towns where Waste Minimisation demonstration projects have run, or where Waste Minimisation Circles are successfully working. In such places, taking advantage of the success of the earlier schemes, new industries should be attracted to experiment with pollution prevention. In such places the testimony of people who are otherwise known to them will definitely help the credibility of the scheme.

(4) Environmental NGO's should be approached to convince them of the usefulness of the pollution prevention policies. For example, the Magsasay Award winner M.C.Mehta can be persuaded to incorporate the concerns of pollution prevention in the public interest litigation that he fights in the courts. Many of the environmental NGO's ordinarily concern themselves only with matters of planting trees, and animal welfare. There is a shortage of NGO's that look into the pollution aspect of environment. NGO's which are presently engaged in the biological preservation can be persuaded to look into pollution control and they may atleast argue for change in the attitude to pollution prevention. The appeal to these environmental NGO's should be to upgrade themselves to complete environment instead of dealing only in forestry wildlife and related subjects.

(5) Press management is an important part of the campaign. The NCPC can sponsor articles, or invite the reporters of the industrial press to visit units which have been benefitted by pollution prevention

working of the units to enable them to get working capital from the banks. The banks can set up an administrative mecahanism to screen the prosecutions launched by the enforcement agencies and form their own opinion about the working of the units. The banks can take an administrative view on the prosecutions launched by the pollution control boards, instead of relying on the success of the prosecution in a court of law. The existing practices do not compel banks to stop lending even when a unit has been convicted by a court. This also has to change.

Banks should have a professional interest in the adoption of waste prevention in industrial units because that increases the profitability of the units. The only task to be undertaken is to convince the banks how waste prevention adds to the profits of the units. Bankers will get educated if the general awareness creation programmes becomes successful. However Government also should issue directions to the banks to introduce waste-prevention-friendly lending policies with manufacturing units.

Administrative changes needed in the working of the Pollution Control Boards.

(1) It is difficult to transform the judicial system to suite a quicker and more effective administration of environmental laws in the country. It is not feasible for the judicial system to give more weightage to environment than the routine criminal and civil disputes that come before the courts. Therefore what the pollution control boards should look for is to tackle violations of environmental regulations through administrative measures.

Pollution control boards have got substantial administrative powers under the environmental laws to punish the violators of regulations. They hardly use

these powers for disciplining the units. The boards often take shelter under the defence that there is no political will for strict implementation. This is because they are always looking for the best solutions. For example the Boards would like to close down a factory which has violated the standards though they do not know how to tackle the political problems that may arise from such an action. If the Government wants, it can mobilise forces to coerce the industry to comply with the standards, but the politicians shy away from it because they do not want to take unpopular decisions. Finally, the option for closing down a factory is abandoned and the Boards withdraw into inaction.

The boards have never thought of opting for the second best options or even third best options. There is no denying the fact that the political executive will go along with the boards if the boards impose a fine of a few thousand Rupees and the burden of fines can gradually be increased to rest at a level which is politically acceptable. This may not stop the factory from polluting, but it will lead to several advantages. First of all it is an educational process. Secondly a unit which gets punished over a long period of time would find it difficult to defend itself before a political forum or a court. Thirdly it will increase the income of the board which can improve its financial muscle for improved performance in enforcement of laws.

(2) Often industrial units establish the pollution control equipment and then do not run them to save recurring expenditure on pollution treatment. Most often the Pollution Control Boards are satisfied with the mere fact that a unit has installed the equipment and the boards tend to concentrate their energies on other units which have not done this or whose equipments are not in working order. The procedure for identifying the units which do not work

primary treatment and deserve the highest punishment for their utter irresponsibility.

Of course a detailed exercise has to be carried out at the time of fixing the MINAS norms. The same data that has been collected, can be used for categorising the four levels of pollution. It is easier to make the four levels in cases where there are primary and secondary treatments needed.

In all cases, one level should be exclusively reserved for those who follow Cleaner Production, without doing any treatment of the pollutants. That should form the third level of punishable pollution. This will encourage many units to opt at least for the level of reduced pollution possible with Cleaner Production.

(3) The World Bank credit line should be available for introducing new technological improvements for pollution prevention. Commercial banks can also be persuaded to extend such loans for small and medium scale units. The financial implications of prominent sets of pollution prevention technologies should be worked out.

The same line of credit should also be available for the expenses that are incurred by a unit when it makes an assessment of the cleaner production options available to it.

(4) Government should set up a publicity machinery for the propagation of the idea of pollution prevention. The present emphasise is on general awareness of environment among the common people. No money is spent on specifically targetting the industrial units.

For this purpose, a specific programme is being suggested below:

A few newspapers and periodicals may be selected in which articles on success stories of cleaner production options are to be published. These news papers and periodicals should be those which are normally read by industrialists. Quotations may be invited from syndicates of article publishers for publishing materials on cleaner production in these periodicals. They will be paid according to column x inch x the circulation of the periodical. The material that has to be published should be approved by an authorised officer.

The advantage of this scheme is that the Government need not worry about the selection and preparation of the articles, or their quality and readability which will be the commercial responsibility of the the syndicate, and the government has to only make payments according to the length of the article.

(5) The Government should institute awards for the best pollution prevention effort in industries.

This would not require fresh efforts because, even now the government has instituted awards for pollution control. The only modification needed is that any unit that complies with the standards, with a higher percentage of pollution reduction by cleaner production should be chosen for the award. This change in criteria can be advertised so that it gives a boost to the Cleaner Production campaign.

(6) The Government should notify under the Environment Protection Act, making it compulsory for all industrial units to prepare a pollution prevention plan which will be examined by the respective Pollution Control Boards and if the plan is not of practical use, the industrial unit can be asked to rewrite it. This can be done in the place of

environmental audit that is currently being enforced. Only five percent of the total number of units file the audit statement and even those who file it do not state the real facts. The whole procedure has become totally redundant and can be replaced by the submission of yearly pollution prevention plan.

Here we may find out why the environmental audit scheme has failed in our country. In many developed countries, environmental audit is carried out with commendable reduction in the pollutant levels. But this is always done on a voluntary basis. In our country it is a statutory obligation on the part of the entrepreneur to have an audit done on his unit, either by himself or by an expert and the results communicated to the prescribed authority. There are not many competent consultants who can carry out an efficient environmental audit, in our country, and even if there are, the exercise is bound to be expensive. Therefore, the audit exercise is rarely done. The statutory statement is filed with ideal figures, and no review of the processes is undertaken.

There is another reason for filing the ideal figures. The statement is to be submitted to the State Pollution Control Boards who are also the enforcement agencies. No entrepreneur would risk the consequences of passing on information about the real state of affairs so as to invite punitive action from the Board. Some units even behave worse. They do not submit the statement at all. And the authorities close their eyes on this. As a result, the audit scheme has become almost extinct.

However the intent behind the scheme cannot be faulted. We have to look for some other programme, that can serve the same purpose. If the units do not have to provide information on pollution levels, the risk involved in filing the statement can be eliminated. Therefore it is suggested that the units

may be asked only to submit a plan of action on waste prevention. The State Pollution Control Board or any other body can examine the plan of action, and suggest modifications.

The unit should execute the plan and the Pollution Control Board should verify it. Another way in which the compliance of the plan can be ensured is by involving the workers in it. The annual plan for waste prevention can be a document in which the workers are also associated. Workers can watch the progress of implementation of the plan. If the plan is not implemented properly, workers can alert the Pollution Control Boards. A fine can be imposed on units which do not honour the commitment of implementing the plan, in stead of the current provision of imrisonment for defaulters. Defaulting units go scot free because the penalty is so severe that the enforcing agencies do not have the mind to award it. Fine is a more workable punishment.

(7) The managements of industries should be compelled to train their production executives in pollution prevention. How this can be done has to be seen in detail.

The Government can establish an Institute of Pollution Prevention where production executives of industries can be compulsorily trained for pollution prevention methods. So long as such an institute is not established, an already existing institute can be given this additional responsibility. There can be a notification under the Environment Protection Act making it compulsory on the part of all industrial units to train their executives who draw salaries above a particular amount. All such executives should be forced to undergo the prescribed training within a period of (say) two years from the date of notification. The training period can be for a period

of one week, or if this is considered too long, for a period of two or three days.

If there are sufficient number of such executives the institute can organise campus training also. If more than one institute is given this responsibility, they can compete with each other in giving quality training.

(8) The Government may organise meetings of the owners of a particular industry along with their technical managers to participate in discussions on the desirability of introducing pollution prevention methods in their industries.

(9) Under a change in the Company Law, now it is compulsory for companies to nominate an officer as the environment officer. This officer can be asked to undergo an intensive training in pollution prevention.

(10) Government may persuade the top industry associations of the country to hold seminars on pollution prevention.

These seminars should focus attention on the advantages that local industries can derive in terms of international competitiveness. The Indian industrialists should be made to understand that they are globally competing with industries which are already following waste prevention techniques, and they will suffer in the long run for their neglect. Seminars should be organised for different regions and for different sectors so that there is adequate participation.

(11) Government may announce a pollution prevention week, to highlight the national interest involved in introducing pollution prevention in industrial units.

(12) Since the judicial forums are playing a more decisive role in pollution control, by adjudicating the public interest litigations, it is essential that the idea of pollution prevention is effectively communicated at the time of hearing of public interest litigations in the courts. The Government, when ever it is asked to comment on the issues involved in public interest litigations, should invariably harp on the theme. The Government advocates should request the courts to find out from the industrial units, whether they have done any thing in the direction of pollution prevention.

Government should organise seminars only for government advocates and those officers who look after court work, in the Government and Pollution Control Boards. Seminar should be held on the subject of "Cleaner Production and public interest litigation on environment."

(13) The Government has introduced an Eco-mark scheme which has not really taken off. The scheme suffers from various weaknesses, like very high qualifying standards, and the low market advantage in a country which is not very much value pollution control. We can think of an alternate scheme with similar look for the furtherance of the concept of Cleaner Production. The eco-mark scheme need not be tampered with.

A new logo has to be created for Cleaner Production. Whoever is practising cleaner production beyond a prescribed level, should be allowed to use the logo. For example it can be awarded to units which comply with the Minimal National Standards and which use cleaner production techniques or practices to achieve more than ten percent of their pollution control. The administering agency of the scheme can survey the potential for cleaner production in different industries and varying percentages can be

fixed for different industries. The scheme has to be simple and should not aim at achieving impossible targets. These were the main draw backs of the eco-mark scheme, which ultimately did not allow it to take off.

(14) Pollution Prevention campaign should not be taken up by the Ministry of Environment alone. In fact its relevence is more to the global competitiveness of the industrial products manufactured in India. Therefore the Ministries of Commerce, and Industrial Development also should treat the campaign as their own, because it serves their interest as well.

This is definitely a difficult task. Officers of other ministries often treat environment as an inconvenient subject. If the attitudes are to change, officers should get some training in various pollution control methods and the advantages of pollution prevention. Ministry of Environment can organise a workshop to explain the advantages in terms of global competitiveness to the officers of the Commerce and Industries Ministries. The workshop should also discuss how these ministries can push the cleaner production programme by dovetailing it with their own ongoing campaigns. These workshops should be an annual feature till industries generally accept cleaner production in a routine fashion.

(15) The Indian commercial banks are mostly under Government control and most of them have adopted a lending policy based on environmental considerations. They will not lend money to industrial units unless they fulfil the environmental conditionalities prescribed under the laws. However this is only in the beginning. If the initial clearances are fulfilled the banks start lending money to these industrial units and no periodic checking of their functioning is done by the banks. It is possible that the banks take upon themselves the task of ensuring the environmental

For example punishments can be graded for different percentages of violations. For each industry four sets of standards should be introduced. Each set will attract a separate level of punishment. The maximum existing punishment is reserved for the highest violators.

The present laws stipulate fine, imprisonment or both, for violations of the prescribed standards. This is an example of drawing a line and treating every one on the other side of the line with the same punishment. For example, small pulp and paper industry has to comply with the MINAS of 100 BOD. A unit that discharges BOD of the level of 1000 and another unit that has an effluent BOD of 150 will face the same punishment. In fact in many cases the industry does not have a viable technology to bring down the BOD to the prescribed levels. For example distilleries are saddled with a prescribed BOD level of 30, and almost all the units find it impossible to achieve this level. If there is no differentiation in the prescribed punishment for a unit discharging 5000 BOD and another discharging 100 BOD, the units will not have any incentive to bring down the pollution level to the lowest possible mark. If they have to face prosecution and possible punishment, the units may try to search for legal loopholes, than spend money on effluent treatment or waste minimisation.

If there are four scales of punishment, the units will get distinguished between gross polluters and those who fail to reach the exact standards by a small margin. For example, the distilleries, who discharge a BOD of 30 to 200 can be treated at par, and 200 to 1000 can form the second group. The third group can be those who pollute with BOD between 1000 and 10000 and the fourth category can be those who generate more than 10000 BOD. If a unit discharges more than 10000 BOD, it is clear that they have not even done the

suggestions are independent of the concrete course of action proposed in the preceding paragraphs.

(1) Government should consider more viable methods of implementing environmental laws, as a result of which no industrialist is able to escape the provisions of law. For example, departmental adjudication of violations can be introduced. Designated officers of the CPCB can be asked to adjudicate complaints filed by the State Pollution Control Boards before them. The CPCB can have an adjudication wing, with officers having knowledge of law and pollution control technologies drawn from different departments of the Central or the State Governments to serve as adjudicating officers. Such adjudications can end up in fine, and appeal against the order of the lower adjudicationg officers can be allowed only after a specific percentage of the fine is deposited with the CPCB. This will put pressure on the units to comply with the legal provisions. This practice is followed effectively in the taxation departments.

This is a suggestion made on the pattern of the working of the taxation departments. In these departments there are two ways to tackle violations of laws. One is prosecution in a criminal court. Tax violations are criminal offences and conviction of an offender can be secured if the department moves a court. However, in majority of the cases, the departments do not pursue criminal prosecution. Only in very serious examples of tax evasion, the departments opt for criminal prosecution. In all other cases, the tax departments try to punish the guilty with a fine. The fine is imposed by officers of the department, specially designated for this purpose. The proceedings of such forums are of a quasi-judicial nature.

The advantages of having departmental adjudications are several. Firstly the cases can be expedited, since, rigorous evidential support is not necessary in adjudications. The criminal courts follow the directions given in the Evidence Act, while the adjudicating officers are guided by the principles of natural justice. Therefore the cases can end up in quicker decisions. The adjudicating officers can only impose fines. No jail terms can be awarded by them.

Fines produce impacts equal to the economic instruments that are often used in the developed countries. The only difference is that the economic instruments make consequences more transparent and predictable, since the scale of payment of charges are obvious to the violating unit, even before it pollutes. In the case of adjudicative fines, the consequences are not absolutely certain or accurately predictable. However, adjudicative fines can serve as an approximation of economic instruments if the scale of fines are also laid down with reasonable precision.

There can be a hierarchy of adjudicating forums. The normal adjudication should take place at the level of the State Pollution Control Boards and the CPCB should act as the appellate adjudicating forum. Any appeal should be entertained only after the defaulting industrial unit deposits a definite percentage of the fine, awarded by the lower adjudicating officer. This can discourage defaulting units trying to file appeals with the sole aim of delaying execution of the order of the lower adjudicating officer. Final appeals can lie with the High Courts.

This suggestion would necessitate amendments to the existing laws, since such a scheme was never envisaged when the earlier legislations took place.

(2) The legal provisions should be changed to incorporate credit for partial compliance of MINAS.

The above mentioned steps can be effectively taken only if there is a unified command at the highest governemt levels. It is recommended that a Joint Secretary is seperately nominated to oversee the project as delineated above, and the Central Pollution Control Board is made responsible for the implementation part. The Central Board should be able to coordinate action between itself and the State Boards.

The scheme should be approved by the environment minister so that there is ample support at every subordinate level. A period of one or two years may be earmarked for bringing a specific number of units under the cover of Clean Production.

It is also suggested that a seminar to explain the strategy and to clear any doubts from the enforcers may be organised in the near future to start of the scheme. Preferably the Minister, Environment should preside over the seminar and all officers of the ministry connected with pollution control should attend the seminar.

OTHER POLICY INITIATIVES THAT CAN BE PURSUED AT THE CENTRAL GOVERNMENT LEVEL

A large number of new initiatives are possible at the instance of the Government which can ensure a better climate for the adoption of cleaner production in the Indian industry. These are not mutually exclusive, and as they are listed below, some of them even duplicate the efforts. But all the measures suggested below deserve to be considered and the most appropriate among them may be chosen for implementation in a coordinated manner. These

The advantage of this strategy is that the unit cannot approach political leaders to bail them out of the situation. The Board can easily convince the politician that the recommended practices are income generating for the industry and they are objecting to it only because they are stubborn and totally irresponsible. The politicians, in the normal course, will not interfere in such a situation.

6. Private consultant firms can offer money back guarantee for the installation of cleaner production techniques.

In the meanwhile some private consultant firms can be made ready for the installation of equipments that can help cleaner production practices. These equipments can be installed and ran for a period of two or three months so that the fruits are clearly evident to the units. Still in case the units want to get out of the commitment, they should have the freedom to get back their money.

This will make it easier for the Board to convince politicians or courts which may intercede on behalf of the units. No court or any sensible politician will ever argue against such harmless action which would only add to the profits of the unit.

As mentioned earlier, this is a course of action which is workable in the legal and political environment in the country. This takes care of the available political will to introduce the concept of Cleaner Production. There is no additional burden on any institution and no additional legislation is called for. Better utilisation of the existing legal provisions is tapped for the purpose of promotion of Cleaner Production.

COORDINATED ACTION REQUIRED.

2. Sell the idea of cleaner production to these units.

Since these units are spending money on pollution treatment, the cleaner production options are attractive to them. They can be easily persuaded to shift over to cleaner production options wherever they are possible. The entrepreneurs are committed to environmental goals and they should be too willing to experiment with less costly options.

The experiments in these units should be journalised and they should be subjected to close scrutiny as to their replicability in other similar units. After certain period, such practices and technical modifications should be identified which can be recommended to other similar units. The package that can be on offer to units which are similarly placed should be prepared out of the experiments done in the units that voluntarily adopt pollution control practices.

3. Identify the most influential units among those who do not comply with standards.

The word influential is not used in the political sense. It is meant to refer to units, which, if they adopt cleaner production techniques, would motivate other units to follow suit. Such units should be identified and kept for priority action for the enforcement operation as explained in the following paragraphs.

4. Take samples from such units.

It is true that the State Pollution Control Boards are not fully equipped to check the effluent and emission samples of all non-complying units. But it is not difficult to concentrate on a few selected

units. Samples of the above mentioned non-complying leader units will be collected and checked in the laboratories. If the samples fail, the Board can either prosecute the units or can take executive action under section 33A of the Water Act or under similar sections of the Air Act.

Here the Boards should take action under Section 33A, and issue directions for the stoppage of operations of the units and invite objections if any from the units.

5. Modify the direction to the the units if they agree to implement the package prepared for their category of industry as explained in paragraph 2.

Section 34(5) of the Water (Prevention and Control of Pollution) Rules, states as follows:-

"The Central Board shall within a period of 45 days from the date of receipt of objections, if any or from the date upto which an opportunity is given to the person, officer or authority to file objections whichever is earlier, after considering the objections, if any, sought to be directed and for reasons to be recorded in writing, confirm, modify or decide not to issue the proposed direction."

This section authorises the officer to modify or withdraw the direction. He can pass an order saying that the unit has agreed to introduce cleaner production practices as per the package prepared by the experts and therefore, direction to stop the functioning of the unit is withdrawn on condition that within a prescribed period, the unit will implement the cleaner production practices. He can also say that the unit will face closure if the unit does not implement the package of practices recommended by the industry experts.

create a situation in which the improvements can be self propelled. This is definitely a time consuming task. Government has been making efforts in this direction for a long time. These efforts have not been a thumping success. Even after twenty years of awareness creation, there is inadequate political will to control pollution. If the awareness creation was successful, the country would have been resolute in controlling pollution and those who donot comply with pollution control regulations would have been dealt with an iron hand. But this has not happened.

Why it has not happened on these lines is not difficult to find out. In a developing country, where a significant section of the people live under the poverty line, any action that curtails job generation is looked up on with disapproval. Damage to environment caused by unregulated industrial activity, will take time to demonstrate in terms of deteriorating living conditions, where as unemployment is immediate and people affected by unemployment and poverty look for quick solutions. Where as environmental degradation is a community problem, unemployment is an individual problem. Even in developed countries, a rise in unemployment percentage leads to reduced spending on environment. Therefore creation of awareness to enhance the acceptability of harsh pollution control measures is not a very realistic solution. It does not yield quick results.

However one should not leave this line of action. The Government should aim at improving environmental awareness among masses, so that even the small improvements in the perception of people make it easier to enforce pollution control measures.

The second part of the question of governmental action is to maximise effective enforcement within the constraints imposed by the present level of political acceptability. It is very clear that the enforcement

agencies are not utilising the available political will to the maximum extent for producing optimum results. In fact the enforcement agencies are so inflexible and wooden in their approach that there is a large gap between what can be done under the existing political sanction and what actually is being done. This is the area which should be looked into more closely, for identifying solutions for accelerating acceptance of pollution control measures and cleaner production as an alternative. The enforcement agencies have to be innovative in their approach, and businesslike in their actions.

A SPECIFIC COURSE OF ACTION TO PROMOTE CLEANER PRODUCTION

On the basis of the arguments explained in the foregoing titles, a specific course of action is proposed which can take care of the promotion of cleaner production in India.

1. Identify the units which are already complying with standards.

Although most units are not complying with pollution standards, there are a few prestigious manufacturers who do not show any laxity in complying with standards. They spend a lot of money on adhering to standards mainly because they realise their social responsibility and do not like to choose the easier path. Some manufacturers comply with standards becuase they occupy leadership roles in the industry associations and do not want to be seen to be defaulting. The number of industries that voluntarily comply with standards may not be more than ten percent of the total and it should not be difficult to prepare a list of such units because their habits are known to their colleagues in the industry and the pollution control boards are also fully aware of such units.

environmental norms on the vehicles, the general public welcomes such actions.

WHAT IS CLEANER PRODUCTION?

UNEP defines the concept of cleaner production in the following terms: 'Cleaner production is the continuous application of an integrated preventive environmental strategy to processes and products to reduce risks to humans and the environment.'

For production process, cleaner production includes conserving raw materials and energy, eliminating toxic raw materials, and reducing the quantity and toxicity of all emissions and wastes before they leave a process.

For products, the strategy focuses on reducing impacts along the entire life cycle of the product, from raw material extraction to ultimate disposal of the product.

The barriers to introduction of Cleaner Production can be listed as follows:-

(1) The environmental laws of the country are not scrupulously enforced. Therefore the entrepreneur has the option of not doing anything to control pollution as a result of which he is not enthused about the cleaner production options which are definitely more expensive.

(2) Even in areas where the cleaner production options are economically viable, without calculating the environmental benefits, the entrepreneurs are not willing to invest money because they are not aware that the returns can be so quick and fabulous.

(3) The present environmental laws in the country and their enforcement, practically emphasises the

technical standards and not the performance standards. This has happened because the entrepreneurs are in the habit of cheating in the matter of regular working of the pollution control equipments. Ultimately what the government agencies ensure is that the pollution control equipments are installed. They are not able to ensure that they function effectively because that require much more manpower and efficiency on their part.

(4) The present environmental laws stipulate full compliance of the MINAS. There is no credit for partial compliance. An entrepreneur who falls short of the MINAS only by a small fraction is liable to be punished with the same penalty as another industrialist who has not even attempted to comply with the standards.

(5) Lack of financial resources. The entrepreneurs of medium size industry do not have sufficient financial clout to introduce technological improvements that can result in pollution prevention.

(6) Many entrepreneurs feel that the time and effort that is needed for introducing pollution prevention methods can better be utilized in improving other areas of profitability, like marketing or raw material procurement etc. This feeling comes from an erroneous appreciation of pollution prevention. In fact the entrepreneur should realise that in pollution prevention, he is competing with himself while in other activities he has to compete with his rivals. Competing with oneself is eminently more easy, but this awareness has to be inculcated.

WHAT THE GOVERNMENT CAN DO?

There are two parts to the reply. One is to improve the general awareness about environment and to

One very interesting aspect of the failure of Pollution Control efforts in the country is the conceptual confusion that prevails in the mind of the people. It is also encouraged by the educated environmentalists. A recent advertisement in the Delhi newspapers inserted by Delhi Administration reads as follows:

"Plant trees. Trees can give out oxygen, and clean the air."

This is a wrong statement. If the concept advocated by this newspaper advertisement is accepted there is no need for any pollution control equipment, or pollution treatment facility for a manufacturing unit situated in a forest, surrounded by trees. This is a scientifically invalid argument. But such a full page advertisement in prominent newspapers, did not provoke any protests because people accept the concept propagated in the advertisement. It is in tune with the convictions of the people of our country. In order to understand the conceptual vagueness of the nature and demands of pollution control, we have to go back to the ancient Indian philosophy.

In contrast to the western philosophy of conquering nature, Indians believed in the principle of living in harmony with nature. The Indian answer to the question of environmental degradation is to desist from tampering with the natural order of things. Use of technology for increasing the comfort of human beings is alien to the Indian mind. The ancient Indian sages would rather advise abstinence from the pursuit of comfort in order to avoid environmental calamities than recommending technical solutions to the environmental problems that arise as a result of exploiting nature to enhance the comfort of human beings. This is the central dilemma of the Indian society as far as pollution control is concerned.

As we all know, modern India has been influenced by the western ideas of industrial activity for economic development. On the one hand our country wants to progress, eliminate poverty, find employment through increased industrialisation, but we are also held back by our age old reservations about finding technical solutions to the problems that arise from the exploitation of nature. We want to go back to nature. That is the spring from where the idea of offering nature as a solution to pollution arises.

This attitude is scientifically and technically untenable. Nature is not a solution to the problems of pollution. Pollution is caused by technology and solutions have to be sought in technology.

But it is not easy to propagate this idea to the people of India. It is true that ultimately Indians will have to change their attitudes, because the current attitudes are scientifically not sustainable. How ever, attempting a change of mind of the Indians is to try the impossible because these convictions are there for thousands of years and will not yield to changes in a period of a few years or even a few decades.

Therefore the only feasible short term action plan is to identify the elements of the Indian mind that helps the cause of cleaner production and make the maximum use of such firm grounds to launch the drive for cleaner production in the Industries.

In the cities, people have realised the harm that is being caused by the ever increasing number of automobiles. Generally people do not understand the composition of the gases that are emited by the vehicles. But people realise that they are not good. All smoke that comes out of the vehicles is considered harmful to human beings. If there is enforcement of

It can be argued that it is wrong to refer to a total neglect of the environment in India. In a country where there are stringent environmental laws, and an elaborate machinery to enforce it, it is preposterous to say that environment is totally neglected. It is true that the environmental laws look formidable on paper. However, the reality is that they are almost inoperative and totally ineffective in compelling the entrepreneur to spend money on pollution treatment or engage his efforts on pollution prevention.

At best, the only function that the elaborate legal provisions ensure is some harassment to the offending units. Such units will have to humour the pollution control officers on a permanent basis and occasionally face the judicial proceedings which may continue for a very long time. This also involves some cost to the units. It may not be more than ten percent of the cost of installing pollution treatment facilities, and therefore it can be safely said that under the Indian conditions, cleaner production can succeed only if it is cheaper than ten percent of the cost of installing pollution treatment. In a large number of cases it would not be.

Here we may understand the concept of cleaner production in detail. This concept has appeared after environmental thinking has undergone a few earlier phases. The first phase was concerned with the huge waste dumps that became larger and larger in every city in the industrialised West. The worry was, what to do with the accumulated wastes. That naturally led to the next phase, which was concerned about the way in which wastes could be treated before they are released into the atmosphere. This phase lasted for a long time, and has recently given way to the concept of pollution prevention or cleaner production.

The Indian pollution control regime is inadequately implemented is only one of the problems. A more serious problem is the shift to technical standards at the enforcement level, from the performance standards as professed in the legal documents. MINAS is the reflection of the performance standards. But in practice, firms are compelled to instal pollution treatment facilities and the enforcers are satisfied if the unit has installed a treatment facility. Whether the treatment facility is regularly used to treat the effluents is not scrupulously verified. The two main reasons why it is not being done is the paucity of manpower and facilities with the enforcement agencies and the devious methods employed by the industries to avoid treatment of effluents.

It is interesting to look into the reasons how an officially legislated, performance standard based, pollution control regime has practically become a technology based administration. In my opinion, this turn around has come only because of the difficulty in proving the offence. For any unit it is difficult to hide the fact that it has not installed the pollution treatment facilities. Even under the liberal judicial system in the country, the units would not be able to prove that they are complying with standards when they have not even installed the treatment facilities. But in cases where the facilities are installed, the industrialists find it extremely easy to beat the regulations. They will confidently claim that they are complying with the standards and with so many loopholes available in the judicial system, they successfully get away with non-compliance. In fact it is not the pollution control laws that have to be blamed. It is the judicial system which includes the prosecution and evidence collection that has to bear the responsibility for the gradual shift of performance based standards into technology based standards.

site clearance, but it has no excuse for not verifying those units which have applied for site clearance and not followed it up with application for consent. The total number of cases filed in courts (since 1974) under the various provisions of the Water Act is only 1915. Many of them must be relating to failure of the water samples collected from the units which have valid consent to operate. Briefly stated, majority of the units which should have applied for site clearance did not do so, and majority of those who sought site clearance did not apply for consent to operate and the Board has totally failed to unearth all the unauthorised units and bring them under prosecution.

The table quoted above shows that the State Pollution Control Board had collected effluent samples of only 4674 units in the state in the year under report and only 116 samples failed to reach the standards prescribed. Any one working in the field would know that this is unrealistic. There is hardly any unit that can pass the test of standards, and if only 116 units failed, there must have been other reasons why the samples could meet the specifications.

In the year under report, 178 cases were disposed of by courts and only 1 case ended in conviction under the Water Act. Since 1974, a total of only 9 convictions have taken place in the state of Gujarat. The annual report does not speak of the number of conviction orders which were set aside by the appellate courts. If that number is also taken into account, the conviction rate would still come down. The question as to whether environment has improved in the country need not worry us at all because it could not have improved with this level of enforcement. If a single unit is convicted out of a possible 1,50,000 operating industrial units, the enforcement of the environmental laws in this fashion cannot be expected to improve the environmental conditions.

Gujarat is a good indicator, not only because the state is industrially more advanced but also because it is a better administered state than others. The conditions in other states are only a shade worse than in Gujarat.

We may attribute a number of reasons for the failure of the board, from the lethargy of the officers to the absence of a strong political will. Why a large number of units applied for site clearance and did not bother about obtaining the 'consent to operate' is also worth probing. It is most probably due to the conditions of lending institutions. They refuse to process loan applications for setting up industries, in case the site clearance is not available. The same conditionalities of loaning can be extended to later working also. The fact that it has not been thought of is also worth looking into. This will be analysed in detail in the later chapters to arrive at some practical solutions that can help improve the enforcement of environmental laws in the country.

CLEANER PRODUCTION CANNOT BE PROMOTED IN A COUNTRY WHERE ENVIRONMENTAL ENFORCEMENT IS POOR

For the time being, we are worried about the lax enforcement because it works as a strong disincentive for the acceptance of cleaner production in the industry. Cleaner Production has to be financially attractive to the entrepreneur to receive his attention. In a country where cleaner production is pitted against pollution treatment, the entrepreneur would easily find cleaner production as a viable and cheaper alternative to treatment. But in a place where cleaner production is an alternative to zero compliance of environmental laws, the idea will not get easy acceptance. It is an undisputed fact that Cleaner production cannot compete with total neglect of the environment.

Sl.	Particulars	During the year 1993-94	Cumulative upto 31-3-94
1.	Number of cases filed in the court		
	(a) Under Water Act.	116	1915
	(b) Under Air Act.	1	328
	(c) Under s.133 Cr.P.C.	26	217
	Total	143	2460
2.	Number of cases disposed of		
	(a) Under the Water Act.	178	594
	(b) Under the Air Act.	37	149
	(c) Under s.133 Cr.P.C.	22	182
	Total	237	925
3.	Number of cases pending in the courts as on 31-3-94		
	(a) Under the Water Act	-	1321
	(b) Under the Air Act	-	179
	(c) Under s.133 Cr.P.C.	-	35
	Total	-	1535
4.	Important decisions of the courts		
	(a) Under the Water Act		
	- Ad-interim injunctions restraining industries from discharging trade effluent.	5	383
	- Ad-interim injunctions		

	confirmed	21	68
-	Passing of conviction orders. (Imprisonment or fine or both)	1	9
	(b) The Air Act		
-	Punishment in the form of fine for operating industrial plants without the consent of the board or for not providing Stack monitoring facilities	1	38
	(c) Under s.133 Cr.P.C.		
-	Orders/injunctions issued by the executive Magistrate	8	127
5.	Action taken under Air Act		
	(a) Notices issued under s. 31 A of the Air Act.	201	422
	(b) Directions issued under s. 31 A of the Air Act.	54	110
6.	Action taken under the Environment Protection Act		
	(a) Cases recommended to the State Government for taking action under s.5 of the EPA.	30	162
	(b) Directions issued by Central Government for closure of industries under s.5 of the EPA.	-	6

(c) Directions issued by the State Government under s.5 of the EPA	6	85
(d) Legal notices issued under Hazardous Wastes (Management & Handling Rules	28	71
(e) Cases filed in the court under the EPA for non-compliance of the Hazardous Waste (Management and Handling Rules)	1	1

The above table and other information given in the annual report demonstrate how the command and control system has thoroughly failed to improve the environmental scene in the country. Gujarat is one of the most industrialised states in India. ("There are 16,048 industrial units, and 1,70,000 SSI units in Gujarat." - Manorama Year Book 1997. In 1994, the number might have been lower by 10 to 20 percent.) The Pollution Control Board acknowledges the receipt of 11640 applications (since 1974) for site clearance, but admits to have granted only 4930 'consent to operate' under the Water Act. It is unbelievable that the other units which applied for site clearance have not started operation. The majority of the units running in the state belong to the small scale sector and must not have applied for site approval at all. If they are added, the number of those who operate possibly without consent would swell many times. The fact is that the State Pollution Control Board has been able to take cognizance of only a small percentage of those who are operating with out a valid consent. The Board may, to some extent, explain its inability to trace units which have not applied for

The concept of environment and the efforts to combat environmental degradation has undergone several changes in the last twenty five years. In the beginning awareness about the degradation of environment grew in the west and the greatest worry at that time was how to tackle the accumulated wastes. The next stage saw the concern for managing industrial operations with out degrading the environment. In order to achieve this, countries insisted that their industrial units should not releae untreated pollutants into the environment. This was the period when the policy of pollution treatment gained overriding importance. 'End of the pipe treatment' was the norm. The concept of Cleaner Production or waste prevention gained ground only in recent times.

Through these changes in the understanding and operations of pollution control, the developed world changed their strategies to improve the environment. They often changed their laws to suit the requirements as per the latest understanding of the environmental problems. They also experimented with newer methods of pollution control. For example, in Europe, countries experimented with the concepts of best available technologies, Bubble theory, imposition of pollution charges and tradeable permits etc. Some of them achieved limited success and some of them failed. But experimentation continued unabated. Technologies also kept pace with the development of environmental concepts.

The biggest inhibiting factor for the promotion of Cleaner Production in our country's environmental regime is the lack of flexibility in the legislative mechanism to change legal provisions with a view to suit the changes in the concepts of control of pollution. Our environmental laws allow only minor amendments and do not allow major changes in the approach to the problem. Our system is incapable of

identifying the bottlenecks that come in the way of cheaper and easier management of pollution, and do not allow experimenting with innovative ideas. We are saddled with the laws which were framed at a time when pollution control meant pollution treatment and they continue to operate even when the concept has been given a go by in the developed countries.

Another constraint is our approach to the generation of pollution based on the old concept of treating it as a crime. This is rooted in our cultural preference for non-interference in the laws of nature. Whoever disturbs the natural order needs to be punished because it is a sin and a crime. Deterrence is the philosophy we follow in the case of pollution control, while in most of the developed countries pollution is treated as an externality and the effort is to compel industry to internalise the cost of pollution. Market forces can take care of pollution if its cost is internalised in the price of the product.

ENFORCEMENT OF ENVIRONMENTAL LAWS IN THE COUNTRY IS POOR

How far the environmental laws have been successful in punishing the guilty can be gauged from the statistics published by the state pollution control boards, which are primarily responsible for their enforcement.

The following is a reproduction of a chapter on 'Prosecution Launched and Cases Finalised' from the Annual Report of the Gujarat Pollution Control Board for the year 1993-94.

"The over all position of legal cases under the Water Act 1974, the Air Act 1981, Criminal Procedure Code and the Environmental Protection Act 1986, as on 31-3-94, is as follows:

direction of cleaner production. It is available for units which have facilities for treating the effluents. There is no emphasis on the regular operation of the treatment facility. Mere establishment of the facility entitles a unit to take advantage of the rebate. This falls in the same category of policies which practically insists on technical standards as against the performance standards. From an overall perspective, the Water Cess Act should be viewed as a positive piece of legislation which encourages Cleaner Production.

Some of the schemes that have been introduced for specific results also deserve mention here. One such provision is the Environmental Audit, laid down in section 14 of the Environment Rules. Under this section, every person carrying on an industry, operation or process is obliged to submit an yearly environmental audit report to the State Pollution ControlBoards. The audit report is supposed to contain information on the raw material and other resource input and the quantum of pollutants generated in the unit. The scheme was introduced with the purpose of forcing entrepreneurs to make a self examination as to the level of resource use in their respective units. The State Pollution Control Boards were expected to study the audit report and make inter-unit comparisons and advise the units on possible improvements.

This is definitely the most positive regulatory mechanism in the current environmental set up to encourage waste prevention and cleaner production. This scheme is not directly related to environmental compliance, but is envisaged to help the industrial units to save resources and thereby production costs. The scheme enjoins the units to submit the report, but does not prescribe any punishment for incorrect reporting. The intention is to provide an opportunity to the unit to have a look at its own processes in order to find out whether there is any possibility to

reduce wastes. When the unit compares its performance with the industry norms, the entrepreneur is likely to get a surprise as to his own over-consumption of resources. This can serve as the starting point for introspection and efforts to reduce wasteful application of resources.

The scheme has not been successful for various reasons which will be discussed in the next chapter. Hovever the concept of the scheme cannot be faulted. It could have been an effective tool to expose industry to the great advantages of waste prevention which unfortunately has not materialised. Even now the scheme can be modified and amended to become an effective tool of propagating the message of cleaner production.

The eco-mark scheme also should be viewed as promoting cleaner production. It envisages the award of the eco-mark to the products of an industrial unit which goes beyond mere compliance of the standards. Reducing pollutants beyond the scope of MINAS can be achieved mostly by adopting cleaner production techniques.

Eco-mark scheme as such falls into the category of market based instruments. The scheme envisages financial benefit to environmentally friendly manufacturing units by branding their products under the eco-mark scheme. The good-will in the market for environmentally friendly products will be converted into higher profits for the units manufacturing eco-marked products. Here also the scheme has not met with success. In fact it has not even taken off so far. The reasons for its failure and the ways in which it can be revived to become a promoter of cleaner production will be discussed in the next chapter.

ASPECTS OF THE CURRENT FRAMEWORK THAT INHIBITS THE PROMOTION OF CLEANER PRODUCTION

to ensure the compliance of standards. When violations of standards are so numerous, and corrective steps are difficult to enforce, the Boards decided to concentrate on those units which have not even established the pollution control facilities. Such units are also large in number and the Boards consider it a substantial achievement if those units are forced to establish them. This way what was designed as a performance standard regime practically ends up as a technical standard system.

Performance standards get successfully enforced in developed countries, mainly because units can install automatic and continuous monitoring systems. In India monitoring has to be carried out by physical inspection of the unit by officers of the Boards. In no way can this be continuous, and even the periodicity of surprise checks cannot be frequent, because that would call for the services of an army of inspectors. The element of surprise in the inspections is also difficult. In medium sized and smaller units, processes can be manipulated to produce favourable quality of effluents and emissions between the time, an officer arrives at the premises of the unit and the sample is drawn. The management can easily delay the work of the inspector by some pretext or the other, and can make use of the time to correct the input feed to alter the quality of discharge. In a corruption ridden society there are umpteen other intermediate points where evidence can be doctored before it reaches the eyes of a judge presiding in a court.

In the initial years, we had concentration based standards. This led to the inevitable dilusion of pollutants to escape the scope of law. In fact it used to happen in almost all cases. This procedure stood in the way of not only waste prevention, but also pollution treatment. Later, new standards were fixed on the basis of rate of production. Mass based standards help the adoption of waste prevention

methodologies. The industrial units find it in their interest to reduce pollution load per unit of production.

Heavy punishments prescribed under the environment laws should have helped the waste prevention exercises, as they should have encouraged pollution treatment efforts in the first place. Heavy punishments were prescribed with the aim of pressurising all units into complying with the standards. It has not happened that way is not the fault of the legal provisions, but the fact that administratively, the enforcement agencies have not been able to get timely convictions from the Indian courts. However, when we try to identify the provisions that favour the adoption of waste prevention, heavy punishments prescribed under law should be listed along with other similar factors.

Water Cess Act also has been positive to the cause of cleaner production. It encourages reduced use of water and promotes effluent treatment. The Water Cess Act employs economic incentives to further these causes. The recent hike in the rates of cess has made the Act more effective. After the recent amendments, savings would be substantial, if a unit decides to cut down its water consumption. There is a secondary benifit likely to flow from the Cess Act. When a unit attempts reduction in the intake of water, it is likely to stumble into finding out opportunities for reduction of other resources as well.

The Water Cess Act lays down an economic incentive scheme. There are two rates applicable to the units. One for the units which comply with the environmental standards and the other for those who fail to comply. Therefore the provisions of the Cess Act not only encourages reduced consumption of water, but also forces them to comply with standards. The rebate proposed in the Act works in the opposite

years. The Water Act provision relates to preventing water pollution by treatment of pollutants or preventing the establishment of polluting units in areas which are environmentally sensitive, than preventing waste generation in industrial units. Prevention of pollution started getting the meaning of waste reduction, or waste minimisation only after it was realised that pollution treatment was a costly method of environmental preservation and this idea originated in the developed countries. The idea got attention in India only after the international agencies took it up as their country programme. Therefore it is erroneous to imagine that the Pollution Control Boards are either given the responsibility or they are competent to deal with the job of pollution prevention as we understand the term in current discussions.

Technical standards and performance standards were experimented at different times by developed countries for environmental control. Technical standards were always easier to enforce, although they cannot be said to be very much helpful in promoting cleaner production. At the time of the establishment of any industry, the regulators could specify the technology with which they would permit its establishment. Some countries opted for the best available technologies as a precondition for issuing environmental consent. In the developing world such a regime was impossible due to economic reasons. The technology had to be the best, subject to the condition that they were also economically viable for the level of development of the country. In developing countries, technologies got changed only after long periods. Once a unit was established with a particular technology, it used to continue till it was almost impossible to carry on with the same technology. In a pollution Control regime, where technology based standards are prescribed, units would wait for years before new technological standards are prescribed by

the Government. If a developing country depended on prescribing technologies for pollution control, it would have taken decades before any significant environmental improvement could have taken place.

Our country decided to opt for performance standards instead of technical standards. Performance standards are preferable because they allow industrial units a choice of different options to achieve the prescribed standards. In the case of technical standards, a particular technology is forced upon the manufacturing unit. In the case of performance standards, only the effluent and emission standards are prescribed and the unit is free to achieve the standards by any means that it chooses to employ. Here it should be noted that performance standards are more suited for waste prevention than technical standards, because the units are free to use waste prevention methods to bring down the pollution level, while it is not possible in the case of technical standards.

So far so good. However, performance standards have to be properly enforced if we are to get the benifit as discussed earlier. In case the enforcement agencies are so ineffective that units can get away with doing nothing, performance standards are not even as useful as the technical standards. In the case of technical standards, the agencies could insist on the technology, but a poorly implemented performance standards can be much less effective than a well enforced tehnical standard regime. Prabably that is what we are seeing in our country. In India, there is an easily identifiable trend among the enforcement agencies to insist on installing pollution treatment facilities, with out ensuring that the level of pollution gets reduced as a result of the installation of the treatment facility.

It is happening this way because State Pollution Control Boards have found it beyond their capabilities

Instead we have a set of laws which is very demanding. The industrial units which were not accustomed to any sort of pollution treatment so far were expected to achieve the best of pollution laws and the strictest of standards. Some of the standards are more stringent than those notified in developed countries. Punishments are not light either. The only escape route for those who find it technically unfeasible or those having insufficient know-how to produce the intended results is to resort to the bribing of inspectors or cheating with false samples. In many cases that is what is happening.

There is a big gap between the political will that is required for the enforcement of strict environmental laws, and its level available in our country. This gap would not have created problems if the legal provisions were moulded in such a way that the available political will was planned to be utilized in the optimum manner. The laws could have been framed with the secondary objective of educating the entrepreneurs and the public at large about the need for controlling pollution. This needed an innovative approach. Such an innovative approach is absent in the provisions of law and in the procedures adopted for its implementation. As a result of all these, we have a scenario where the laws looks formidable on paper, though they most often fail to improve the environmental quality.

ARE THE LEGAL PROVISIONS FRIENDLY TOWARDS pOLLUTION PREVENTION?

Though the Central Pollution Control Board is entrusted with the job of pollution prevention along with control of pollution by pollution treatment, it has not taken up the work seriously. In fact pollution prevention used in the list of functions of the Board is intended to convey a meaning different from the meaning attributed to pollution prevention in recent

powers of entry and inspection of all industrial units, as the State Boards.

For the sake of clarity, a few more points need to be mentioned before we make an assessment of the existing framework. The State Boards have to follow the directions issued to them either by the state governments or by the Central Pollution Control Boards. This condition is laid down in the Water Act and the Air Act. In a similar way the Central Pollution Control Boards have to comply with instructions from the Central Government. This is to ensure that the authorities at different levels do not work at cross purposes, and there is cohesion in the environmental enforcement work, through out the country.

As far as the standards are concerned, the Central Government notifies the Minimal National Standards and the state governments have the option to make standards more stringent in case that is needed in some areas of the state. This provides enough room for taking care of areas which are likely to be highly polluted because of the presence of large number of polluting units. This is a half way measure to remedy the anomaly of notifying source standards, without linking them to the ambient standards.

CRITICAL EXAMINATION OF THE EXISTING FRAMEWORK

1. A problem that stares in the face before any thing else is that different enactments were made at different times and they have not been properly synchronised. As a result of this, there are repetitions and gaps in the existing laws. There are parallel provisions in the Water Act, Air Act and the Environmental Protection Act. Since the three acts are similar in nature, the gaps that existed remained as such even after many amendments were made to the three

acts. The Central Government has been concerned about this and an effort has been made to integrate the different provisions of the enactments to draft a single legislation with all the existing regulatory conditions in tact. However this is a tedious task and no results have been achieved so far. This is a procedural flaw in the structure of environmental legislation.

2. The Water Act betrays the country's inexperience in environmental policing. It addresses itself equally between the handling of municipal waste water and 'trade effluents'. It prescribed elaborate instructions on taking samples, establishing laborataries, authorising officers for inspection etc. and remained silent on the principles and procedures for setting up standards for different industries. The provisions of the Water Act were only a general improvement on the various 'nuisance laws' that already existed, in the preventive sections of various criminal enactments and it appeared that the framers were more worried about the possible misuse of the law than its insufficiency to control pollution. When a parallel Air Act was proposed, there was no rethinking on the basis of experience so far gained from the working of the Water Act and was more or less designed as a mirror legislation of the Water Act. Later, when the shortcomings of these enactments came to be widely felt, the Environment Protection Act was framed. This new legislation granted immence administrative powers to the executive. Probably it was swaying a little too much in the other direction. How ever, these excessive powers also did not result in the effective curbing of industrial pollution because, the structure created by the Water Act remained, and in the opinion of this author, is not appropriate for effective executive action.

3. The executive arm of the pollution control set up should have two types of capabilities. It is the

agency which advises the Government on policy issues, and which carries out field research in order to gain enabling information for tendering authentic advice. This is the first role and the skills needed are scientific and knowledge-based.

The second role is that of the enforcer of coercive and punitive clauses of the laws. This requires skills of a different nature. It calls for administrative acumen, political sagacity, and knowledge of procedural and other related laws. Unfortunately it is too much to expect the same agency to excel in both the areas and that is the structure that the Water Act has built and on which the EP Act later leaned on.

Qualifications prescribed for the functionaries of the Boards tilt in favour of scientific and engineering skills. Provisions made for the Member Secretary of the Central Pollution Control Board bear it out.

"A full-time member-secretary, possessing qualifications, knowledge and experience of scientific, engineering or management aspects of pollution control to be appointed by the Central Government." (Section 3(2)f of the Act)

There is no mention of any understanding of law or experience of prosecution. As time went on, it became clear that pollution can be effectively checked only if the coercive and punitive provisions are well implemented. That is why the EP Act chose to have a heavy dose of executive powers. Still the implementation was left with the Boards which is heavily loaded with scientific and engineering skills. This is one reason why the implementation of the laws has been poor. The author of this paper suggests the creation of a directorate of pollution control to look after the coercive part.

4.Coming to more substantial issues, the enactments have to be described as too ambitious in their proposed reach. There is insufficient public support for the implementation of such lofty environmental goals. It can be said about the legislative formulations that they were not brought about as a consequence of grass roots demand for them, but were in a way forced from above. Enlightened public opinion at the elite sections of society led to the framing of such zealous enactments. Such legislations are difficult to implement, unless there is a concerted effort to educate the common people about the need for the stringent social behaviour envisaged under such legislations. On this score the performance of the Governments have been very poor and as a result, the implementing agencies do not get sufficient public cooperation for successful prosecution of the defaulting units. In fact, in a country that is largely illiterate, the seriousness of the damage to the environment is not fully appreciated. The apathy of the common people gets rubbed on to the people's representatives because they would show interest only in subjects which are dear to their voters. Ultimately we get a scenario where the benificiaries of the environmental legislation are themselves not too much interested in their proper implementation. The elected representatives also do not show much interest. The enlightened public who are few in number are the only votaries of strong implementation. Public opinion of this enlightened section was, in the first place responsible for the inititial legislation and even now they are the only people who really support pollution control efforts.

The legislative provisions have not taken these factors into consideration. If these factors were properly considered, the legislation would have attempted humbler goals, at least for the initial stages of enforcement of pollution control laws.

(1) The Hazardous Wastes (Management and Handling) Rules 1989,

(2) The Manufacture, Storage and Import of Hazardous Chemicals Rules 1989,

(3) Rules for the Manufacture, Use, Import, Export, and Storage of Hazardous Micro organisms Genetically Engineered Organisms or Cells,

A number of notifications were also made under the Environment Protection Rules, for effluent and emission standards, guidelines for setting up industries etc.

THE EXISTING FRAMEWORK IN A NUTSHELL

Under the existing framework for environmental control, the Central Government and the State Governments are responsible for policy formulation. The Central Government has an edge in this area as almost all the environmental enactments were passed by the Parliament. Environment does not figure in the Seventh schedule of the Constitution which lists the subjects of legislative competence between the centre and the states, and therefore most of the legislation had to be brought out under the powers enjoyed by the parliament under article 253 of the Constitution which so empowers it for giving effect to international agreements.

There is one more reason why the Union Government has primacy in the matter. As in India, in other federal democracies also, the Union Governments enjoy primacy in matters relating to the business of setting standards. To begin with, states used to fix standards for pollution in the United States. However, it was soon discovered that the states were competing with each other for grabbing business investments, by

increasingly diluting standards. Ultimately, the Union Government had to step in to halt this self-defeating tendency and restore sanity by legislating national standards.

There is a third reason as well in our country. There is more awareness of environmental matters among the Members of Parliament compared to the members of the Legislative Assemblies. This can be illustrated by going through the debates in the respective houses. The legislative assemblies of the States are more concerned with employment generation and industrial development, and consequently their concern for environment receives less emphasis.

Policy formulation through legislation is the core work in pollution control. But technical inputs and advice are needed in order to take decisions on policy issues and this responsibility rests with the Pollution Control Boards. At the national level it is the Central Pollution Control Board and in the States, it is the State Pollution Control Boards who perform this function. Here also the Central Pollution Control Board has an edge over the state Boards, since they have more qualified personnel to tender qualitative advice than the State Boards. It is also the responsibility of the Central Board to provide technical assistance to the State Boards.

After the policies are formulated and corresponding legislations have been enacted, their implimentation is the responsibility of the Pollution Control Boards. In this matter the State Boards have a higher responsibility than the Central Board because they operate at the grass root level. Inspection of industrial units have to be done by the state boards, and the defaulting units have to be prosecuted by them. It is only rarely that the Central Board makes an inspection of a unit and files a complaint in a court on its own, though they also enjoy the same

procedures and get convincing coverage on issues relating to the advantages of pollution prevention.