

MONITORING OUR PROGRESS TOWARD SUSTAINABILITY— DESIRABLE OR UNDESIRABLE?

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SUSTAINABLE DEVELOPMENT CAN BE VIEWED AS AN OPPORTUNITY RATHER THAN AN ADDITIONAL ENVIRONMENTAL BURDEN. THE PAPER INDUSTRY SHOULD ENCOURAGE CORPORATIONS TO ISSUE ENVIRONMENTAL REPORTS BASED ON PUBLIC ENVIRONMENTAL REPORTING INITIATIVE GUIDELINES.

THE WAY IN WHICH WE VIEW ENVIRONMENTAL problems and our level of accountability has changed dramatically in recent years. Of students entering college, 83% believe that government is not controlling pollution and more needs to be done. The view of human beings as able to use natural resources to improve the quality of life has been replaced by a view of them as part of the natural system. We are held accountable for our actions, both to other members of our species as well as to the other forms of life which inhabit the planet. The view from an ecological perspective sees humans as part of the ecology. Our activities must harmonize with nature and be sustainable. The Brundtland Commission defined sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs, which seems like a reasonable ideal to work toward. Young people certainly endorse this concept. It also seems the ideal thing to do from a moral perspective if the costs do not outweigh the benefits. It cannot be accomplished instantaneously, but it can be a goal to work toward and a paradigm by which to make decisions.

SUSTAINABILITY OPPORTUNITY

Sustainable development should be viewed by the pulp and paper industry as an opportunity rather than an additional environmental burden. Considering the long-term view which must be taken by an industry as capital intensive as ours, sustainability is the only system which will work. The trees which are the resource base of the paper

industry are a sustainable resource. In the United States, we grow 32% more wood than we use for solid wood products and paper. We have done a good job of managing the yield from our forests. In the future, we must broaden our view in order to demonstrate to the public how well we manage this resource for multiple use.

Our final products are nonhazardous and recyclable. The public perception of our products is positive. We need to make further strides to design our products to be even easier to recycle and to participate in developing systems for recovering more of the products after use. The 40% recycle goal has been achieved, and the 50% goal is almost reached. Our products are correctly perceived as nonhazardous.

Our manufacturing processes use a minimum of hazardous chemicals, and our record in the 33/50 program has been exemplary. It appears to be technically feasible to close totally the water systems on most of our manufacturing operations, so an effluent-free mill is potentially a possibility. The solid waste which we generate can be minimized. That which we still produce can be shifted to beneficial uses, such as to create synthetic soil or reclaim wasteland. The air pollution problems from our industry can be minimized through control devices but remain an area of concern.

Thus it appears that sustainability is something possible for the pulp and paper industry to achieve. Sustainability should be viewed as an opportunity which we should pursue wholeheartedly, for we should be able to do it more easily and more rapidly than most other industries.

Type of installation Source of information	BKM EKONO study M.E. symp 50% Data	Mech Pulp 50% Data	Deinking 50% data	BKM-50%D EDF 10A WP		BKM 100%D EDF 10A WP		BKM O+100%D EDF 10A WP		SGW EDF 10A WP		TMP EDF 10A WP		Deinked EDF 10A WP		BKM-TCF EDF 5WP		BFR EDF 5WP
				Low Data	High Data	Low Data	High Data	Low Data	High Data	Low Data	High Data	Low Data	High Data	Low Data	High Data	Low Data	High Data	
Water Parameters																		
Water usage cubic meters/ADT																		
Bleach plant effluent, cubic meters/ADT					41.3		41.3		22.4		16.8		16.8		25.8		5.8	
Final effluent volume, cubic meters/ADT	84	40	55	64.3		64.3		32		32		0.2		0.2		0.9		30.2
BOD, kg/ADT	2	1		0.3		0.3		0.3		0.3		3.3		3.3		11		17
COD, kg/ADT	30			15.8		15.8		15.8		15.8		0.5		0.5		0.4		
TSS, kg/ADT				0.2		0.2		0.2		0.2		0		0		0		0.01
Effluent AOX, kg/ADT	1			1.54		0.6		0.1		0.1		0		0		0		0.01
Dioxin																		
Color, kg/ADT				100		100		19.7		19.7								2
Chronic toxicity																		
Air emissions, lb/ADT																		
Particulates				10.4		11.5		9.4		9.4		9.6		11.1		3.3		
TRS				0.43		0.44		0.43		0.43		0		0		0		
Methanol																		
Chlorine																		
Chlorine dioxide				9600		9800		9400		9400		3600		4300		1100		
CO/Carbon dioxide				7.3		9		4.8		4.8		13.7		16.3		4.8		
NOX				9.3		12.6		4		4		25.2		31		9.2		
SOX				5.4		5.9		5.3		5.3		3		3.4		0.9		
VOCs																		
Dioxin																		
Opacity				2.5		2.1		2.4		2.4		0.3		0.3		0		2.754
HAPS - Total																		
Acetaldehyde																		
Formaldehyde																		
Chloroform																		
Solid Waste																		
Total generated, kg/ADT		20		200		200		200		200		180		180		380		
Primary sludge																		
Secondary sludge																		
Recovery dregs																		
Power boiler ash																		
Energy Utilization																		
Total energy utilized, millions Btu/ODT				29.9		32.5		27.2		27.2		23.5		27.6		7.8		10.5
Self generated energy				28.4		28.4		30.4		30.4		3.5		3.5		0		3.1
Purchased energy				1.5		4.1		-3.2		-3.2		20		24.1		7.8		7.4
Pulping Parameters																		
Kappa																		
Yield																		
Sustainability index																		
Percent of total points possible																		
L Miami University database of parameters on pulp and paper manufacturing																		

Type of installation Source of information	BKM-TCF		News-REC		Office-Virgin		Corr-Virgin		Corr-Rec		CUK		SBS		SBS		BKM-Mix		BKM-Mix	
	Low EFF	EDF 5 WP	News-Virgin	EDF-Final	Office-Virgin	EDF-Final	Corr-Virgin	EDF-Final	Corr-Rec	EDF-Final	CUK	Board-Vir	EDF-Final	CUK	Board-Rec	EDF-Final	SBS	Board-Rec	EDF-Final	Per Rep 94
Water Parameters																				
Water usage cubic meters/ADT																				
Bleach plant effluent, cubic meters/ADT																				
Final effluent volume, cubic meters/ADT	6.15		44.5	60.4	70.5	66.4	33.6	6.63	6.63		388.8	6.63	70.5	6.63		6.63	6.63		60.2	
BOD, kg/ADT	2.91		2.5	6.1	6.1	6.1	3.7	3.6	3.6		3.6	2.1	6.1	2.1		2.1	2.1		2.05	
COD, kg/ADT	8.9		36.3	27.5	89.2	27.6					30	5	81	5		5	5			0.48
TSS, kg/ADT			4.8	6.9	9.88	6.9	5.8	1.88			5.9	1.7	9.8	1.7		1.7	1.7		2.75	0.59
Effluent AOX, kg/ADT					2.6	0													0.85	
Dioxin																				
Color, kg/ADT																				
Chronic toxicity																				
Air emissions, lb/ADT																				
Particulates			13.2	7.2	12.2	7.3	7.88	5.6			8.2	6.6	11.7	6.6		6.6	6.6		0.96	
TRS					0.3	0					0.4	0	0.4	0		0	0		1	
Methanol																				
Chlorine																				0.014
Chlorine dioxide			14242	3461	20080	3574	16790	3180			17641	2834	20698	2834		2834	2834		0.071	
CO/Carbon dioxide			23.7	14.9	18.2	14.7	14.1	12.3			14.1	12.4	18.5	12.4		12.4	12.4			
NOX			40.1	24.7	25.8	25.4	20	21.7			19	20.6	25.9	20.6		20.6	20.6		11.59	
SOX			3.9	1.7	5.4	1.7	6.7	0.5												
VOCs																				
Dioxin			2.754	0.4	0.15	0.2	4.3	0.002			3	0.03	2.4	0.03		2.4	0.03			
Opacity																				
HAPS - Total																				
Acetaldehyde																				
Formaldehyde			1206	459	1146	577	964	269			956	290	1098	290		290	290			
Chloroform																				
Solid Waste																				
Total generated, kg/ADT			36.4	20.8	37.9	21.3	27.6	18.4			28.3	17.5	39.4	17.5		39.4	17.5			
Primary sludge			3.1	0	23.8	0	12.7	0			14.6	0	21.6	0		21.6	0			
Secondary sludge			33	20.8	14.1	21.3	14.9	18.4			13.7	17.5	17.7	17.5		17.7	17.5			
Recovery dregs																				
Power boiler ash																				
Energy Utilization																				
Total energy utilized, millions Btu/ODT																				
Self generated energy																				
Purchased energy																				
Pulping Parameters																				
Kappa																				
Yield																				
Sustainability index																				
Percent of total points possible																				

Type of installation Source of information	BKM NSPS- monthly	UBK NSPS- monthly	TMP NSPS- monthly	Deinked NSPS- monthly	NI fine NSPS- monthly	Tissue NSPS- monthly	BKM MISA-91 EBE-K3	BKM MISA-91 EBE-K4	BKM MISA-91 EBE-K5	BKM Dev. Doc BAT	NI-Fine Visit 6/96 Mill A	NI-Fine Visit 6/96 Mill B	NI-Fine Visit 5/96 Mill C	BKM Visit 8/96 Mill D	BKM Visit 7/96 Mill E
Water Parameters															
Water usage cubic meters/ADT															
Bleach plant effluent, cubic meters/ADT															
Final effluent volume, cubic meters/ADT							104	104	104		12.8	8	21.6	17.5	20
BOD, kg/ADT	0.365	0.315	0.208	1.21	0.922	0.363	1.79	1	0.5		3.2	2.8	11.9	1.1	2.39
COD, kg/ADT		24.6					83	64	57	25.4				22.9	
TSS, kg/ADT	0.383	0.982	0.598	1.388	0.921	0.221	2.91	2.25	1		0.7	2.8	5.1	2.5	3.78
Effluent AOX, kg/ADT							0.9	0.37	0.23	0.156				0.7	0.515
Dioxin															
Color, kg/ADT										76.3				45.8	
Chronic toxicity															
Air emissions, lb/ADT															
Particulates															
TRS											1.58	0.78	0.105	1.76	4.84
Methanol												0	0	0.0286	0.2
Chlorine															
Chlorine dioxide															
CO/Carbon dioxide															
NOX											11.8	11.6	19.36	14.96	4.4
SOX											22.2	0	32.64	9.46	1.1
VOCS											1.56				0.55
Dioxin												170.5			
Opacity															
HAPS - Total												0	0.015	0.0726	
Acetaldehyde															
Formaldehyde															
Chloroform															
Solid Waste															
Total generated, kg/ADT												282	271	150	72
Primary sludge												405			
Secondary sludge												48			
Recovery dregs															
Power boiler ash															
Energy Utilization															
Total energy utilized, millions Btu/ODT														33	
Self generated energy														32.75	
Purchased energy														0.25	
Pulping Parameters															
Kappa															
Yield															
Sustainability index															
Percent of total points possible											640	405		900	865
											75	48		90	86.5

I. Miami University database of parameters on pulp and paper manufacturing (continued)

The paper industry's realization of this is demonstrated by the American Forest and Paper Association statement of environmental health and safety and its statement on sustainable forestry. We must now make sustainability a reality. Our accounting systems must be brought into line with what Roy E. Weston termed natural economics. There is only so much natural wealth produced by the forests, and this is what we can utilize on a sustained basis to run our industry. Our accounting systems must show all true costs from a sustainability perspective rather than be structured for short-term gain. For an excellent overview, I recommend the pamphlet on sustainable development which Weston introduced at the TAPPI 1994 Environmental Conference.

The new perspective our industry must have is the industrial ecosystem perspective wherein we account for all our products, as well as all our wastes, from cradle to grave.

EVOLUTION OF ENVIRONMENTAL POLICY

We started with a pollutant-specific command and control structure which is still present in our regulations. This then evolved to a negotiated rule-making strategy which became a collaborative rule-making approach. It was then decided to integrate all forms of pollution considerations together, which became the integrated rule-making approach. This in turn seems to be evolving to a stakeholder participation dialog process.

We may be evolving to a state where voluntary initiatives are the way to proceed. Such initiatives have several inherent advantages:

- Preserve the right to operate
- Reduce cost
- Provide business opportunities
- Enhance the social attractiveness of the business.

Voluntary initiatives improve the paper industry's relationships with communities and regulators and increase chances for reasonable responses to expansion plans, permit renewals, and other issues. They give the impression that ill-conceived laws are unnecessary. Voluntary initiatives reduce cost by reducing litigation associated with accidents. Responsible environmental management uses resources more effectively and produces high quality safety programs. It provides a customer-focused business approach and enhances a company's reputation as a supplier. Voluntary initiatives level the playing field and make products attractive to the socially conscious customer. They help attract the best and the brightest to become employees of your company and make existing employees proud to be a part of such a progressive organization (1).

Water	final effluent volume	cubic meters/ADT
	BOD	kg/ADT
	COD	kg/ADT
	TSS	kg/ADT
	AOX	kg/ADT
	color	kg/ADT
Air	particulates	lb/ton
	TRS	lb/ton
	HAPS	lb/ton
	NOx	lb/ton
	SOx	lb/ton
Solid waste	total generated	kg/ADT
Energy	total energy utilized	MM Btu/o.d. tons
	energy purchased	MM Btu/o.d. tons

II. Key quantitative environmental parameters

HIERARCHY OF MONITORING

We have certainly evolved in what we are required to monitor in order to define pollution. We were first required to monitor effluent volumes and resource depletion. Such parameters as gallons of effluent per ton of production, BOD, and suspended solids were commonplace. These parameters were supplemented with measures of effluent toxicity, both acute and chronic. Issues of bioaccumulation emerged. We are now concerned with color and odor, which are less easy to measure. Issues of biodiversity are also of concern. We are looking with a higher power lens at all environmental matters. This is clear from the increased monitoring requirements. The only way to get ahead of this process is to move to voluntary compliance and begin to exert some control over it.

CORPORATE ENVIRONMENTAL REPORTS

A good way to influence public opinion is through the use of corporate environmental reports. This idea was pioneered by the chemical and petroleum industry and has spread to telecommunications and manufacturing. The paper industry is beginning to utilize the concept. A group of companies developed the Public Environmental Reporting Initiative (PERI) guidelines, which describe in general how these reports should be structured for most effective communication. To date in the United States and Canada, 17 pulp and paper companies, mainly the large

¹Frank, R. F. Jr., "Preparing for 2000: Moving beyond the chlorine controversy in an expanding global marketplace," TAPPI 1996 Environmental Conference Proceedings, TAPPI PRESS, Atlanta.

Factors	Maximum Score ^a
Company profile	
Size of company: sales dollars/year and number of employees	
Production index: tons/employee	
Environmental policy	50
Does company have a statement of environmental policy?	
Date of its introduction/revision	
Environmental management structure	100
Prepare organizational responsibility chart	
Board of Directors: how are they involved?	25
TQM system?	10
Resources devoted to environmental activities: dollar amount and percent of total sales.	50
How are resources apportioned to meet federal, state and local regulations?	
Educational programs for environmental staff?	15
Forestry	150
What fraction of wood usage comes from company-owned land?	
Is clear cutting practiced? On what fraction of company's land?	
	Softwoods? 5
	Hardwoods? 10
What fraction of forested land is replanted? What are your reforestation practices?	30
Do you make seedlings available for private land?	10
Do you operate seed nursery plantations? Do they use genetically selected trees?	10
Do you practice selective cutting? What fraction of your lands are selectively cut?	20
Do you cut on federal or state lands and, if so, is reforestation part of the contract(s)?	10
What are your practices for logging roads?	10
What are your practices on stream buffer zones?	10
What percent of your forests have you set aside as a biological diversity preserve? How do you manage for biodiversity?	20
Do you have endangered species on your lands? How do you manage them?	10
Mill processes	300
Do you have secondary biological treatment?	30
Are you in compliance with your water permit? If not, what number of violations occur per year?	10
Water discharged in gal/ton.	30
Energy usage in Gjoules per ton. What is your company's energy use reduction plan?	50
Are you in compliance with your air permit? If not, what number of violations occur per year?	50

III. Sustainability survey and index

multinational companies which have a corporate environmental staff, have issued such reports. These reports do not all comply with the PERI guidelines (2), but most do. Most companies perceive this practice as a very beneficial thing to do, even if their environmental record is less than perfect. The public seems to view reporting as an act of trust, implying that something will be done about whatever problems still remain. It would be desirable for all paper companies to adopt this practice.

As a group, the paper industry in Wisconsin, through the efforts of the Wisconsin Paper Council, has adopted this idea. Each year as part of their P3 pollution prevention initiative they issue a report which tells the state of each mill installation (3). In 1996, 27 mills reported their

environmental progress, and many adhered to the PERI guidelines. The mills in Wisconsin are very positive about how the P3 initiative has changed their relationship with the state regulatory agency and given them more influence over future directions in the environmental area. In going beyond an environmental report, some companies and organizations have developed environmental indices to aid in documenting and communicating their progress.

KEY PARAMETERS TO MONITOR

Environmental information should always be quantified as much as possible. To aid in this process, the Department of Paper Science and Engineering at Miami University has developed a spreadsheet database for different

²Public Environmental Reporting Initiative Guidelines. Can be obtained from Dr. Paul Tebo, Vice President, Safety, Health & Environmental, DuPont, 1007 Market St., Wilmington, DE 19898.

³Pollution Prevention Partnership; Second Annual Progress Report. Wisconsin Paper Council, January 1996.

What fraction of your mill furnish is from recycled material?	20
Can you share data from the TRI reporting forms? Baseline data from past three years.	30
Do you dispose of any hazardous waste? If so, how much and by what disposal method(s)?	20
Does your mill participate in the EPA 33/50 program? If so, do you have encouraging results?	20
What is your company's plan to minimize solid waste generation at your plant site, and what success has been achieved? How is your solid waste disposed of? Have you found, or are you practicing, any beneficial uses for solid waste?	40
Environmental risk management	100
Does your plant conduct environmental audits? If so, how many in the last two years and how extensive?	30
Describe your company's emergency response programs. Have you conducted practice drills?	40
Describe your company's safety and hazardous exposure training program.	20
Number of accidents per 500 employees last year.	10
Product stewardship	50
What is the range of products you manufacture?	
Do your products fit into established recycling schemes?	20
Do you make any products which are not recyclable? Do any of your products have components that are not recyclable?	20
Have you worked on (re)designing your products to minimize environmental impact?	10
Public education	50
Do you keep your work force informed about environmental matters? How?	20
Do you do liaison work with your community's environmental commission?	10
Do you give public tours of the mill? How frequently?	10
Do you publish any public education material on your company? How is it distributed?	10
Research and development	50
What fraction of your company's profits are spent on research and development?	
Environmental compliance	100
Record of compliance for water, air, and solid waste for the last three years.	
Significant penalties (over \$25,000) experienced in the last three years.	
Programs implemented to correct the problem situation(s).	
Employee recognition	50
Does your company have an environmental stewardship recognition program?	

^aTotal possible points are 1000 with forestry holdings, 850 without.

types of pulp and paper manufacturing to help mills benchmark their environmental progress. This database as of November 1996 is shown in **Table I**. Its list of parameters is quite extensive, and most mills do not have data on all of them. A more reasonable list is presented in **Table II**. The units suggested in this table reflect the common ones utilized by our industry. It is interesting to note that the water and solid waste parameters have made the shift to metric, but the air and energy units have not.

ENVIRONMENTAL INDICES

Although it is best to express environmental information quantitatively, there are many environmental considerations which can be described only qualitatively. These, however, can then be reduced to a relative quantitative

scale—an environmental index.

For an entire corporation, the International Chamber of Commerce has developed a business charter for sustainable development containing 16 principles to which businesses should adhere to accomplish sustainability. Under their Global Environmental Management Initiative program, they have developed an index that will determine how sustainable a corporation is (4). This is an excellent index but too general to provide guidance toward specific actions for the pulp and paper industry.

The financial community has developed corporate environmental profiles through the Investor Responsibility Research Center. These profiles include an emissions efficiency index, spill index, and compliance index. Indi-

^aGlobal Environmental Management Initiative, Environmental Self-Assessment Program. ICC Business Charter for Sustainable Development, 1st edn., September 1992.

vidual companies have developed indices to track their performance and continual improvement. Nortel Corporation of Canada has developed such an index for a utility under the assistance of A. D. Little. Using these two approaches as a guide, I have developed a mill-specific index for pulp and paper manufacturing plants. This proposed index is presented in **Table III**. I felt it was best to do this on a mill-specific basis because all paper mills are custom installations which differ significantly from one another. Well designed and operated plants should be rewarded.

To date I have applied my draft index to ten mills, and it seems to work quite well. It takes about four hours of a senior environmental person's time to complete all the qualitative and quantitative information. I usually request the quantitative information ahead of time, take a quick one-hour tour of the facility, and then spend about two hours with a mill environmental engineer to complete the index form. I have been impressed with the depth of thought and effort mills have exerted to become environmentally friendly.

The scores have ranged from a high of 900 of a possible 1000 (90%) to a low of 408 of 850 (48%). Larger mills seem to be scoring higher than smaller ones, but that may be just an accident of sampling, since only a limited number have been surveyed. Some judgment is obviously involved in the scoring.

There are several reasons for and against creating such an index. On the positive side, it gives a quantitative basis on which to judge overall progress. The index gives a perspective on the total job to be done. It also gives a means of communicating with nontechnical people. The index may be useful as a public relations tool, although when the AFPA examined the concept, it found that the focus groups were not impressed. Leading companies in the sustainability movement are adopting the concept.

On the negative side, the index is an oversimplification of a complex issue. It will create a basis for comparison between different types of pulp and paper companies; this may be like comparing apples and oranges. The index may be used in marketing products, and consumers may buy certain companies' products based on their perceived environmental friendliness. Lastly, the proposed index has been created by an individual and organization allied with the industry. It might be more credible if a noninvolved third party developed the index. Weighing both sides, I feel the scales tip toward having such an index.

SUMMARY AND CONCLUSIONS

1. The paper industry is in a better position than most other industries to institute sustainable development as an operating practice.
2. The industry must move beyond compliance to a sustainability policy, or laws may be passed which will significantly affect its competitive position.
3. All companies should institute a corporate environmental report based on the PERI guidelines to improve their communication with the public.
4. A quantitative sustainability database of key environmental parameters has been developed which can be used to benchmark environmental progress.
5. An index has been developed which expresses the environmental practices of a given mill installation as a single number which can be useful in documenting the installation's progress and improvement. **TJ**

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