GUIDELINES FOR BETTER MANAGEMENT OF INTEGRATED PULP & PAPER MILLS AND COST REDUCTION MEASURES

By

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This article is an effort to provide a systematic listing of factors defining the financial position of the mill, its profitability and problem areas. These data provide a base to assess the economics of running the Mill and will update the areas that need improvement to bring up efficiency and thereby better return on the investments made. To enable achieving this are shown questions of strategic importance in day-to-day operation. Finally there is a list of questions which need to be answered.

Financial position factors

The data in tables I - IV provide the type of basic financial and process control information that might be presented as a summary with the Mill's monthly cost statements. This can be evaluated weekly and summarised once a month.

Table - I Highlights the development of unit cost figures for wood and steam. Wood/bamboo cost is far and away the most important single factor affecting Mill profitability. But it is not unusual to find greater attention paid to factors that have far less impact on the balance sheet.

Where it is possible to exert some control on chip quality and reduction of dust in the chipping operations, with a judicious combination of proper maintenance and use of good grade knives, this operation yields direct savings in cost. By the same token, steam costs are usually a significant portion of the overall per-ton cost. Generally, more effort is expended in controlling steam usage; but a ten percent reduction in unit steam cost will have the same effect on pulp cost as a comparable reduction in steam usage. Similar is the impact of cost of make-up fresh alkali used for pulping.

The format of table-I provides for the detailed information that is needed for full disclosure. It will be noted that budget figures are indicated for both unit cost and unit usage.

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Table-II illustrates an item to item breakup of Mill variable cost. Included are the overall figures for wood and steam that were developed in Table-I. Some operating summaries of this type shows only the cost per ton and the cost variance.

A more complete format is strongly favoured because it precisely pin-points the sources and amounts of variance. The extension of variance should concern itself with the "Why" rather than "what". In some specific instances, it may be observed that a reduction in unit cost off-sets a higher usage, unless a total picture is presented, the higher usage may go un-noticed.

It may occur to some of us that table-II belongs more in the hands of the plant accountants rather than with Mill management personnel. It is true that the accountant prepares the summary but he does so as a service to the manager. Tables of this type provide the economic picture of the Mill; and every manager and supervisor must become adept at reviewing this information. Although the accountant should colour code all negative variances in red, it remains for the manager to decide how serious the situation is and whether any immediate remedial action is needed.

Table III provides an interim item by item break-up of fixed costs. Generally these factors have less effect on the balance sheet than the variable cost and as a result less attention is paid to them. Nevertheless variance should be watched and reasons understood together with corrective actions taken.

Table-IV shows a grade by grade comparison of costs and profitability position on average production rates. This data provides an important operating guide for the Mill Manager and has some option in selecting the productmix. It is of interest to know from the same sheet the impact of various record production rates on Mill profitability. Therefore, the production rate has a great effect on how profitability the grade will be.

Some may still rank low in the Mill profitability if the production rate must be corrected due to one reason or the other.

Questions on strategic importance

While a summary of information such as is shown so far and indicate possible problem areas, it is not by itself enough with the why's and whereof's of the Mill operation. In order to know the process and to closely monitor the same, it is necessary to obtain answers to some strategic questions that pertain to the main control aspects in the major areas of Mill operations.

Table-V provides such a list of questions split-up into various Mill areas. If a careful thought is given to, this list will allow a person who is conversant with the general operation of the Mill to gauge the type of performance in terms of the sophistication and level of the answers. While it will be useful to apply certain standard values against all the operating parameters, which is not always possible to do so in a meaningful manner because of difficulties in operation or equipment.

In certain areas these is lack of general agreement that a certain value is either good or bad. It depends on the processing objectives and whether certain constraints are built into the process or by way of raw material, equipment, or any other factor. However, a collection of data from several Mills will lead one to assess and determine the average sort of performance depending on the type of Mill, its production, the type of pulp that is being produced and the age & efficiency of the operation.

Under the area of general questions it can be seen that there are several unpleasant questions posed such as the percentage of rejects. This will be a subjective figure since the percentage of reject paper or pulp is a function of the grading procedure in the Mill i.e. a Mill can be overly scrupulous to the extent that it makes a large quantity of off grade paper or alternatively it can never make any rejects worth mentioning. For this reason the operating people shall have to be careful in interpretation of such figures. However, such questions will at least lead anyone to a discussion of the type of operation that is practised at any given time and the Mill.

The stock pumps, agitators and mixers have been known in many Mills to give considerable problems with regard to reliability, maintenance and exposure to this and the screen plate breakage problem will indicate whether or not the Mill has been plagued by these problems either during start-up or during subsequent operation. The same principle will apply to the corrosion problem in places like digesters, pipe racks, condensers at TG house and the evaporators as well as recovery boiler area and causticizers. This has happened in almost all Mills. Another critical area where the corrosion is encountered is the washers, washer wires, chlorine mixers, heater mixers. All these areas will indicate whether or not the Mill is aware of the potential hazards which can occur in these areas without sufficient attention. One should, of course always be watching out for such things as an untidy Mill, spares parts lying all around, or the stock on the floor, or various ledges.

Poor house-keeping practices are usually symptoms of limitations of manpower or laxing supervision and may indicate problems encountered in addition to manpower available and general employee morale.

Detailed check lists

Table VI presents an extensive set of questions that can be used to produce a manual describing the main operating features of the Mill. A comparative tabulation of answers for such questions from similar Mills will enable one to evaluate the Mill's performance in relation to others. Also enclosed are questions of management philosophy in terms of manpower utilisation and training, profitability of grades and how the particular operation compares with other Mills for which data are relatively available. It should be kept in mind that an answer to a question sometimes has greater consequence than is first apparent. The fact that an answer is forthcoming at all usually indicates that this area of the operation is under observation at least on a recurring basis. In the event that no answer is obtained the reason for the omission, should, of course, be explored in more detail. It is useful for the organisation to take a periodic look at the pulping and paper manufacturing operations. We should question whether the present operating standards and practices are competitive with respect to productivity, product yield and quality, and operating and maintenance cost.

The Pulp and Paper Industry handles as much as 8-10 Tons of input materials for every ton of finished paper. All these materials are to be brought in by rail or road and therefore, it can be related to material handling operations rather than paper manufacture. The depletion of forest wealth, especially the only source of long fibre, has to be brought from distant places apart from Coal and Sodium sulphate. It would, therefore, be in the fitness of things that the industry if it were to reduce the cost of production, has to aim at bringing in new technology of pulping and bleaching in order that the raw material is conserved by reducing the losses in pulping and bleaching. The other venue of cost reduction would be to install power boilers that are capable of handling coal with very high ash content and still attaining high thermal efficiencies, namely fluidised bed boilers. The third aspect of cost reduction measure that industry can aim, would be to install energy efficient machineries for chipping, screening, washing, refining and paper conversion etc. in order that the energy as well as water consumptions per

Ton of paper are brought to a minimum level.

It is also needless to mention that electrical machineries installed are rated to the specific operating parameters, in order the power factor is maintained as high as possible. In many instances the energy inefficient motor generator sets can be replaced by efficient thyristor drive systems. The cost reduction programme should also include mechanising some of the operations like converting, finishing, reel and ream packing, wherein the industry as-on-date spends considerable amount of money, since these operations are totally manual.

The integrated pulp and paper plants, should also aim at utilising Bagasse as an alternative fibre source and if possible keep these two mills in one compound, in order the valuable bagasse from Sugar Mills is used as the main source of fibre for paper making. This would mean finding the alternative source of fuel for Sugar Industry. We had in the past many deliberations on the use of bagasse for paper making. This idea has already been put to test and practice by two large newsprint mills in this country.

The financial pattern for the installation and operation of a paper mill in this context also assumes importance. The interest burden on the organisations that are dependent on All India Financial Institutions is such that with the current cost of production and with the existing norms for statutory levies, it is nearly impossible to make any marginal profit after providing for interest and depreciation even by large integrated Pulp and Paper Mills.

It would be appropriate at this point of time that the institutions review the conditions, on which the loans are granted to various mills. The gestation period being more than 3 years, increases the burden of interest supplemented by low realisation on account of the market trends. The Government should also review the situation and grant fiscal benefits to the industry by way of excise duty and royalty concessions apart from reducing import duty on machinery and materials. The paper industry is placed at 9-10% on return on capital employed.

The wages and salaries are approximatley 13-14% on the net sales and this has a marginal increase every year. The power and fuel costs are 18-22% of the net sales. This in turn keep on escalating each year with the changing

policy of the Government The incidence of statutory levies the industry has to meet works out to approximatley 50% on the net sales, and this is under the control of the Government. This industry has the highest depreciation to net sales ratio in view of the high capital employed. Overall operating cost as a percentage of sales has shown a very discouraging trend during the past five years. This is on account of the steep rise in the cost of inputs and statutory levies by the Government while the sales realisation has not increased in the same manner. The industry is plagued with these problems and these need to be over come.

TABLE - I

UNIT COST DETAILS

WOOD/BAMBOO SUPPLY	COST PER UNIT VOLUME		BONEDRY WEIGHT PER Unit Volume		Moisture		YIELD PERCENT BDT WOOD/ BAMBOO		COST PER BDT WOOD/ BAMBOO		PERCENT USED BY WEIGHT	
	ACTUAL Rs.	BUDGET Rs.	ACTUAL A	BUDGET B	ACTUAL A	BUDGET B	ACTUAL	BUDGET	ACTUAL A	BUDGET B	ACTUAL A	BUDGET B
CHIPS/LISTING BY SPECIES OR QUALITIES BAMBOO	1050	1000	0.65	0.60	0.35	0.40	51	52	1615	1667	17	20
SOFT WOOD (B.D.)	1000	1000	0.75	0.70	0.25	0.30	51	52	1333	1428	17	20
HARD WOOD (B.D.)	720	700	0.72	0.70	0.28	0.30	52	50	1000	1000	66	60

TABLE - I

UNIT COST DETAILS

STEAM COST (By Fuel)	UNIT FUEL COST (Rs.) PER TONNE		USAGE PER TONNE OF STEAM		COST PER TONNE OF STEAM		VARIANCE	
	A	B	A	B	A	B	Favourable	Adverse
COAL	850	800	0.18	0.20	153	160	7	-

A: ACTUAL
B: BUDGET

TABLE - II

VARIABLE COST - BLEACHED GRADE

RAW MATERIALS	UNIT COST ACTUAL	UNIT COST BUDGET	USAGE PER TON A	USAGE PER TON B	COST PER TON A	COST PER TON B	COST VARIANCE FAVOURABLE	COST VARIANCE ADVERSE	REASONS OF VARIANCE
SOFT WOOD CHIPS	1333	1428	0.25	0.30	333	428	95	-	Less quantity consumed & lower purchase rate.
HARD WOOD CHIPS	1000	1000	1.30	1.30	1300	1300	-	-	
BAMBOO CHIPS	1615	1667	0.30	0.30	485	500	15	-	Lower purchase rate
					2118	2228	110	-	
PROCESS CHEMICAL									
CAUSTIC	6000	6000	0.037	0.035	222	210		12	More consumption
CHLORINE	1500	1400	0.190	0.200	285	280		5	Higher purchase rate
SALT CAKE	3000	2900	0.070	0.075	210	218	8	-	Lesser consumption
TALCUM	1000	1000	0.240	0.230	240	230		10	Higher consumption, resulted in saving of pulp cost.
LIME	900	950	0.490	0.500	441	475	34	-	Lower consumption & Lower purchase rate.
ALUM	1400	1450	0.085	0.080	119	116		3	More consumption
ROSIN	19000	20000	0.011	0.010	209	200		9	
					1726	1729	42	39	
SPECIALITY CHEMICALS	7500	7500	0.041	0.040	308	300	-	8	More consumption
UTILITES									
WATER	0.50	0.50	260	250	130	125	-	5	
STEAM (FROM COAL)	153	160	6.25	6.00	956	960	4	-	
STEAM (FROM RECOVERY)	-	-	4.00	4.50	-	-			
MILL POWER	-	-	850	800	-	-			
GRID POWER	1.05	1.10	800	800	840	880	40	-	Lower rate
MACHINE CLOTHINGS					240	250	10	-	
PACKING MATERIALS					290	300	10	-	
TOTAL VARIABLE COST					6608	6772	164	-	

TABLE - II

VARIABLE COST-UNBLEACHED GRADE

RAW MATERIALS	UNIT COST		USAGE PER TON		COST PER TON		COST VARIANCE Favourable	COST VARIANCE Adverse	REASONS OF VARIANCE
	ACTUAL	BUDGET	A	B	A	B			
SOFT WOOD	1333	1428	0.35	0.4	467	571	104	-	Rate is less due to less moisture.
HARDWOOD	1000	1000	1.30	1.2	1300	1200	-	100	More consumption due to lesser use of soft wood & bamboo.
BAMBOO	1615	1667	0.35	0.4	565	667	102		Rate is less
					2332	2438	206	100	due to less moisture.
PROCESS CHEMICAL									
CAUSTIC	6000	6000	0.028	0.030	168	180	12	-	Lesser Consumption
CHLORINE									
SALT CAKE	3000	2900	0.080	0.075	240	218	-	22	Rate increase as well as consumption is also more.
LIME	900	950	0.450	0.400	405	380	-	25	Consumption is more due low purity.
ALUM	1400	1450	0.070	0.060	98	87	-	11	Consumption is more.
ROSIN	19000	20000	0.006	0.005	114	100	-	14	Consumption is more due to special varieties.
					1025	965	12	72	
SPECIALITY CHEMICALS									
DEFOAMERS									
SLIMICIDES									
DETERGENTS									
SETTLING AIDS	16000	16000	0.010	0.012	160	192	32	-	Less Quantity used.
UTILITES									
WATER	0.50	0.50	200	180	100	90	-	10	More Consumption
STEAM (FROM COAL)	153	160	6.25	6.00	956	960	4	-	Lessor coal rate, more steam consumption due to lower generation of steam from Recovery Plant.
STEAM (FROM RECOVERY)	-	-	4.00	4.50	-	-			
MILL POWER	-	-	650	700	-	-	-		Higher draw from grid due to low generation from captive Plant.
GRID POWER	1.05	1.10	800	700	840	770	-	70	
MACHINE CLOTHINGS					200	200	-	-	
PACKING MATERIALS					250	240	-	10	
TOTAL VARIABLE COST					5863	5855	-	8	

(Rs. in lacs per day)

TABLE - III

FIXED COST

COST CENTRE	ACTUAL	BUDGET	VARIABLE	EXPANSION OF VARIANCE
EMPLOYEES	1.60	1.60		
MAINTENANCE	0.50	0.50		
OFFICE OVER HEAD	0.30	0.30		
POLLUTION CONTROL	0.10	0.10		
INSURANCE AND TAXES	0.05	0.05		
INTEREST	1.00	1.00		
DEPRECIATION	0.50	0.50		
TOTAL	4.05	4.05		

TABLE - IV

COMPARISON OF GRADES-PRINTING PAPER

(Production & Profitability)

	UNIT	GRADE A	GRADE B	GRADE C	GRADE D	GRADE E
Average Daily Production Rate	Tons	125	120	120	115	110
Record Daily Rate-One Month	"	3700	3400	3420	3300	3170
Record Daily One Week	"	880	850	860	800	800
Record Daily One Day	"	130	123	125	118	115
At average Production Rate						
Fixed Cost Per Ton	Rs.	3240	3375	3375	3522	3682
Variable Cost Per Ton	Rs.	6300	6500	6608	6800	7200
Total Cost Per Ton	Rs.	9540	9875	9983	10322	10882
Sales Realisation	Rs.	11500	11750	12000	12500	13000
Mill Profit Per Ton	Rs.	1960	1875	2017	2178	2118
Overall Profit Per Day	Rs.	245000	225000	242040	250470	232980
Profitability Ranking		II	V	III	I	IV
At One-Month Record Rate						
Overall Profit Per day	Rs.	236307	190060	210558	221980	207846
Profitability Ranking		I	V	III	II	IV
At One-Week Record Rate						
Overall Profit Per day	Rs.	248663	232536	257386	246400	257829
Profitability Ranking		III	V	II	IV	I
At One-Day Record Rate						
Overall Profit Per Day	Rs.	271050	240711	269000	267624	261970
Profitability Ranking		I	V	II	III	IV

TABLE - IV

COMPARISON OF GRADES-KRAFT PAPER

(Production & Profitability)

	UNIT	GRADE A	GRADE B	GRADE C	GRADE D	GRADE E
Average Daily Production Rate	Tons	140	135	135	130	120
Record Production one month	Tons	4410	4250	4100	4000	3650
Record Production one week	Tons	1030	990	960	940	850
Record Production one day	Tons	147	142	140	135	125
At average production rate	Rs.					
Fixed Cost Per Ton	Rs.	2693	3000	3000	3115	3375
Variable Cost Per Ton	Rs.	5700	5800	5863	6000	6500
Total Cost Per Ton	Rs.	8593	8800	8863	9115	9875
Sales Realisation	Rs.	9400	9600	9700	10000	10750
Mill Profit Per Ton	Rs.	807	800	837	885	875
Overall Profit Per Day	Rs.	112980	108000	112995	115050	105000
Profitability Ranking		III	IV	II	I	V
At One Month Record Rate						
Overall Profit Per Day	Rs.	138915	133308	119447	128267	112055
Profitability Ranking		I	II	IV	III	V
At One week Record Rate						
Overall Profit per day	Rs.	139491	132377	121234	132137	111107
Profitability Ranking		I	II	IV	III	V
At One Day Record Rate						
Overall Profit Per Day	Rs.	150000	134614	132160	135000	126250
Profitability Ranking		I	III	IV	II	V

TABLE - V

TYPICAL ESSENTIAL OPERATING STATISTICS

1.	**CHIPS**			
	1.1	Bamboo - Bulk Density	BD Kg/m^3	190-220
	1.2	Wood - Bulk Density	BD Kg/m^3	225-250
	1.3	Average moisture	%	10-25
2.	**CHIPS SIZE DISTRIBUTION**			
	-	40 mm - + 35	%	4
	-	35 mm - + 25	%	12
	-	25 mm - + 15	%	50
	-	15 mm - + 10	%	22
	-	10 mm - + 5	%	10
	-	5 mm - + 2.5	%	2
3.	**DIGESTER**			
	3.1	Chips charged/Blow	Tons	18-20
	3.2	Active alkali as Na_2O	%	14-17
	3.3	Fresh chemicals used	%	10-12
	3.4	Chemicals recovered	%	88-90
	3.5	Causticity	%	80
	3.6	Sulphidity	%	20
	3.7	Active alkali conc. as Na_2O	g/1	95-110
	3.8	Unbleached pulp yield	%	46-49
	3.9	Chips to liquor ratio	-	1 : 3
	3.10	Digestion temperature	°C	165-170
	3.11	Stem consumption/ton pulp	Tons	1.8-2.0
4.	**DIGESTER CYCLE**			
	4.1	Chips charging	Min	60
	4.2	Liquor charging	Min	30
	4.3	Time to 165°C	Min.	120
	4.4	Time at 165°C	Min.	60 - 90
	4.5	Blowing	Min.	15-20
	4.6	Contingencies	Min.	10
5.	**WASHING**			
	5.1	Pulp freeness	°SR	15-17

5.2	Dilution factor	Kg/ADKg	3.0-3.5
5.3	Washing chemical loss as Na_2SO_4/Ton AD Pulp washed.	Kg	15-25
5.4	Pulp permanganate No.		20-22
5.5	Con. of black liquor	°TW & °C	14-18 (80°C)
5.6	Weak B.L./ton unbleached pulp.	M^3	7-9

6. PULP CONSISTENCY AT VARIOUS PROCESSING STAGES

6.1	From Digester at Blow	%	10-12
6.2	At Blow tank outlet	%	3.5-4.0
6.3	AT knotter inlet	%	0.9-1.0
6.4	Brown stock washer vat	%	0.8-1.0
6.5	Brown stock washer mat	%	10-12
6.6	Centrifugal Screen inlet	%	1-2
6.7	Centrifugal cleaner inlet	%	0.7-0.9
6.8	Pulp thickener mat	%	10-12
6.9	Chlorination tower	%	3-3.5
6.10	Alkali reaction tower	%	10-12
6.11	Hypochlorite reaction towers	%	10-12

7. REACTION TIME AT BLEACHING

7.1	Chlorination tower	h	0.75
7.2	Alkali reaction tower	h	2.0
7.3	Hypochlorite reaction tower	h	4.0
7.4	**Chemicals used:**		
	7.4.1. As chlorine	%	14-16
	7.4.2. As Caustic soda	%	2-3
	7.4.3. Lime	%	10-12
7.5	Pulp brightness, ISO	%	78-82
7.6	Pulp viscosity	CP	9-12

8. PROCESSING LOSSES

8.1	Bleaching	%	8-10
8.2	Screening and cleaning	%	3
8.3	Washing	%	0.5-1.0
8.4	Knotter screens	%	2.0
8.5	Chipper House	%	4.0

9. RECOVERY

9.1	Steam generated/ton solids	Tons	3.4- 3.6
9.2	Lime/Ton Caustic soda	Tons	1.1-1.3
9.3	Salt Cake/Ton sodium Sulphide	Tons	0.87-1.1
9.4	Average reduction	%	92-94
9.5	Recovery efficiency	%	90
9.6	Sulphur recovery	%	43-46
9.7	Total chemicals charged As Na_2O to Digesters per ton of unbleached pulp.	Kg/ton	340-380
9.8	Ave. Cal. value of B.L. solids	GJ/T	14
9.9	Furnace oil/used ton solids	Ltrs.	15-20
9.10	Ratio of organics to inorganics in black liquor solids.		60 : 40

10. POWER HOUSE

10.1	Steam/ton coal	Tons	4.8-5.5
10.2	Steam/ton furnace oil	Tons	13.5-14.0
10.3	Power generated/ton steam	KWH	90-105

11. MATERIAL QUALITY CONSUMPTION PER TON OF PAPER

11.1	Bamboo and wood Airdry	Tons	2.5-2.8
11.2	Bone dry chips	Tons	2.0-2.25
11.3	Cooking chemicals	Tons	0.34-0.38
11.4	Chlorine for bleaching	Tons	0.160-0.138
11.5	Caustic soda for bleaching	Tons	0.02-0.035
11.6	Lime for bleaching	Tons	0.07-0.10
11.7	Salt cake	Tons	0.06-0.078
11.8	Lime for chemical recovery	Tons	0.360-0.40
11.9	Total solids in black liquor	Tons	1.6-1.7
11.10	Alum in paper machine	Tons	0.05-0.08
11.11	Rosin	Tons	0.006-0.008
11.12	Talcum	Tons	0.17-0.20
11.13	Steam	Tons	8-9
11.14	Coal	Tons	1.2-1.5
11.15	Fuel oil	Ltrs.	25-40
11.16	Power	KWHR	1150-1300
11.17	Water	M^3	200-220

TABLE - VI
DETAILED KRAFT MILL QUESTIONS

General:

What is the designed capacity of the mill; and what are the maximum, minimum and average daily production last year and this year, so far?

Where are the bottlenecks of production in the mill? What is planned to remove them?

Is there any five year or long-range plan for cost reduction, quality improvement, and new process development?

How many shut-downs were there during the last two years?

a) Planned b) Unplanned

What size is the maintenance crew and how are they split?

A) by trades b) byareas or central c) Shift/day

Is there a maintenance planning center?

To what extent is preventive maintenance practiced?

For every ton of product produced, what are the wood, water, power, chemical and man hour consumptions?

How does the mill compare with competitors in regard to production quality and operating costs?

How much off-grade pulp as a percentage of the production is produced and what are the grades and pulp specifications?

What is the number of grades and frequency of grade change?

How many customer complaints were received last year, and how much did they cost the Company?

How were the complaints handled?

What is the most profitable product of the mill and what has been done to increase the production of this product?

Why is that product most profitable? What needs to be done to increase the profitability of the other grades?

Is there a policy to either educate or train workers, engineers and supervisors within the company?

Can the mill be characterized with regard to production emphasis and markets, i.e.:

- Large volume, minimum number of grades?
- Speciality mill, many grades?
- Captive production, single customer?
- Unbleached, Semi-bleached, full-bleached?
- Softwood, hardwood, sawdust, mixed furnish?
- Single line or multi-line mill?

Wood and Chips:

How is wood brought to the mill?

Are chips segregated in chip storage?

What control is exercised in blending the furnish?

What chip screening is available and what is the classification of feed accepts and rejects?

What happens to the reject fines and oversized chips?

What is the nominal chip length?

Are problems encountered with

a) Chip damage? (b) Fines?, (c) Rot?, (d) Chip degredation?, (e) Fires?, (f) Contamination?.

Are chips blown or conveyed to the chip storage?

Howis chip consumption measured?

Are chips derived from integrated operations or are they produced from logs on site?

What type of base is used for chips piles? Concrete? Asphalt?

What are the wood species used? Are the species widely different in density, yield or fibre morphology?

Cooking:

What is the liquor-towood ratio in the digester-Are there any problems with liquor circulation?

What is the active alkali-to-wood ratio used?

What are the maximum, minimum and average sulphidity?

What is the target permanganate number and the standard deviation over a month? How is permanganate number controlled?

What is the yield?

How is the yield measured or calculated?

What steps have been taken to increase yield?

Havethere been any problems with fouling heat exchangers?

What knotting system is used and how are knots processed?

What is the average percent of knots?

What methods of cooking are employed? Batch, M & D etc.?

Is chip packing used? What type?

Washing, Screening and Cleaning:

How many stages of brown stock washing are there?

What is the Baume of the filtrate from each stage?

What are the soda losses from the last brown stock washer?

How is it measured?

Is foaming a problem and how is it handled?

What screening system is used?

Are the rejects refined? Is good fiber refined with the rejects?

What is the percent screen rejects on average?

Is screening and cleaning carried out on the unbleached side or the bleached side?

Are there any outstanding problems in these areas? Is shive carryover to the bleach plant within acceptable limits?

What is the consistency to the primary screens and primary stage cleaners?

How much fiber is sewered?

Are there special types of dirt that cause problems? Fly ash Bark? Contaminants, such as rubber or plastic?

Bleach Plant:

What is the bleach sequence and why?

Are there particular problems with: a) Scale? (b) Pitch? (c) Shives? How are these probles dealt with?

Is viscosity monitored as a control variable?

What is the overall shrinkage in bleaching?

What is the chemical consumption per ton of pulp in each stage?

What targets are used for control, and within what ranges can they be controlled?

Is automatic control used? ORP? Chromatic sensor?

How much recycling or water conservation is practiced in the bleach plant?

What is the steam and water consumption per ton of pulp produced?

What type of equipment is used?

Any special maintenance or corrosion problems?

What are the retention times in each stage?

Is stock blended before bleaching?

Paper Machine:

What type of refining equipment is used?

What is the headbox consistency and temperature?

What is the wire pit PH and acidity and type of control?

What is the AD percent after each press section?

How fast is the machine running?

Are there aids to production, e.g., drainage aid or steam showers?

Is there a sheet cooler?

Is any allowance made for brightness reversion?

What happens to the broke?

What is the water removal efficiency of the dryer?

How frequently are routine quality control tests carried out?

What are the reproductibility and accuracy of each control and laboratory test?

What is the average quality of each grade of product during the last two years?

What pulp is off-grade, how fast is action taken, and what is done to correct the fault?

What is the water, steam, power consumption?

What is the volume of effluent discharged/ton and the fibre loss?

What measures are taken to minimise this loss?

Black Liquor:

What is the frequency of required evaporator washouts?

a) Scheduled? b) Unscheduled?

What is the % solids to Ist effect and its variability?

Is the evaporator equipped with fiber filter? Check operating difficulties.

What is the evaporation efficiency, kg. water per kg. of steam?

High or low? Why?

Is the recovery equipped with a direct contact evaporator: If so, what is:

a) % oxidation? (b) % solids in, % solids out, % of rated throughput?

Specify furnace liquor conditions: a) Flow (LPM)? (b) °C (c) Kg/m^2 : (d) % solids? (e) nozzle and number? (f) Liquor heating value and range for last six months?

Specify furnace combustion conditions: (a) Total air flow (range)? (b) excess air-% O_2 (range)?.

Have lower furnace wall tubes been provided with special cladding or studs?

Is wall tube condition rountinely monitored for: (a) internal corrosion (rate of corrosion)? (b) External corrosion (rate of corrosion)?

What is corrosion history?

Is a burner safety system applied?

What is % reduction in smelt?

Is there a history of smelt/water explosions?

Is there a deposition history of upper furnace? What is the present condition?

Is there a program for soot blowing steam?

Furnace efficiency: heat to steam(Cal/total cal to furnace)?

Estimated solids recirculation load through the precipitator (% of fired solids)? How estimated?

What solids per ton of pulp are handled by the recovery system on the average? Is there a significant difference between grades?

Causticizing and Lime Kiln:

What is the total titratable alkali in wash and green liquor?

Any problem with dregs settling rates in the green liquor clarifier? Are settling aids used?

What is the consistency of the dregs washer rejects? What is the soda loss?

What is the causticizing efficiency in the slaker operation?

Are there any problems with lime mud settling?

Any problem with the lime kiln? Ringing or balling?

What is the oil consumption (Cal value) per ton of lime product?

Is there NaCl buildup in the liquor system? (Applies to coastal mills). How is the NaCl purged from the system?

Miscellaneous:

What is the efficiency of the Hypo Plant?

What storage capacities are available in the mill to act as a surge? (a) Weak

black liquor? (b) strong black liquor? (c) Green Liquor? (d) White liquor? (e) Brown stock (f) Bleached stock?

What is the quality control scheme for the mill? When was the last time this was reviewed?

How much process data is generated "for the record" and how much is used for control?

Are there any plans to install computer or analogue control loops in the mill? Are there any items of special interest, or peculiar to the million question?