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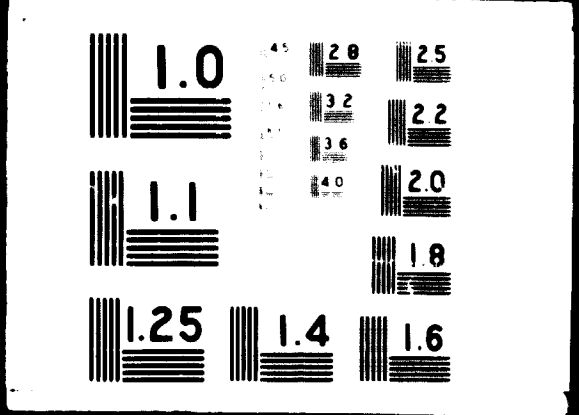
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org



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A PRACTICAL APPROACH TO WASTE PAPER UTILIZATION IN DEVELOPING COUNTRIES

by
Harvey B. Herman
Managing Director
Hermco Limited
Santo Domingo, Dominican Republic

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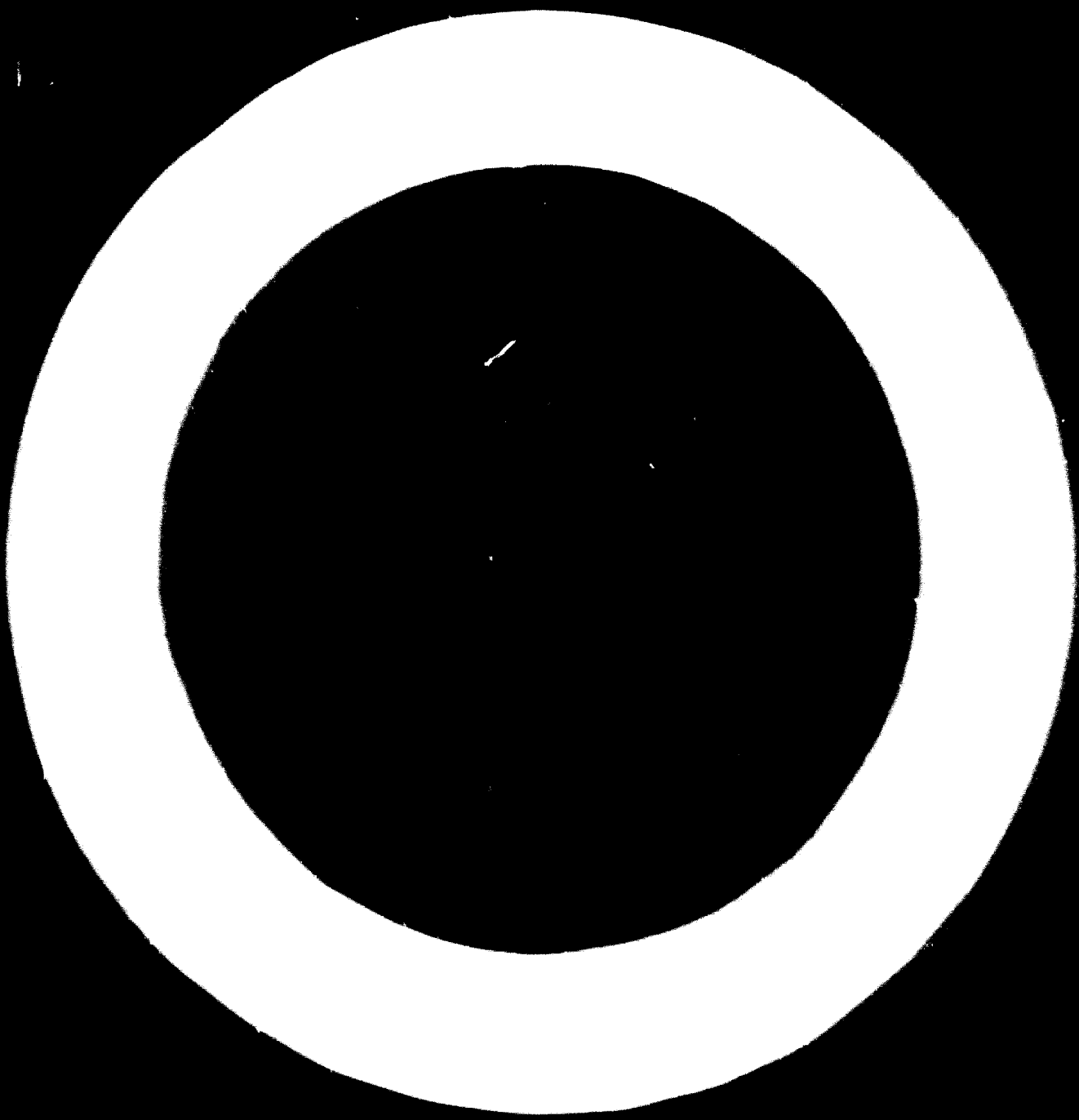


THE TECHNOLOGY OF UTILIZING WASTE PAPER IS EXTREMELY WELL DEVELOPED AND THE LITERATURE IS VOLUMINOUS AND DETAILED. BUT IN SPITE OF THE OBVIOUS FACT THAT UTILIZATION OF WASTE PAPER AS A RAW MATERIAL FOR THE PRODUCTION OF PAPER AND BOARD CAN BE EXTREMELY FINANCIALLY REWARDING, AND CAN RESULT IN GOOD SAVINGS OF VITAL FOREIGN EXCHANGE; MOST DEVELOPING COUNTRIES ARE WASTING THIS RAW MATERIAL.

THIS AUTHOR BELIEVES FROM CONTINUOUS OBSERVATION IN SOUTH AMERICA AND ASIA, THAT THE PRINCIPAL FACTOR IN THE FAILURE TO UTILIZE LARGE QUANTITES OF WASTE PAPER IS A LACK OF PRACTICAL APPROACH ON THE PART OF THE ENGINEERING EXECUTIVES WHO SHAPE THE PHYSICAL PLANT PROCESS IN DEVELOPING AREAS. IN A COMMENDABLE EFFORT TO BE MOST MODERN AND MOST EFFICIENT, THERE IS A NOTABLE TENDENCY TO PLAN WASTE PAPER UTILIZATION PROCESSES IN THEIR VERY EFFICIENT AND MODERN FORMS - AND THEREFORE HIGHLY COMPLEX FORMS; AND THIS INVOLVES HEAVY CAPITAL INVESTMENT. I BELIEVE THAT SOME EFFICIENCY SHOULD BE SUBORDINATED TO SIMPLICITY; THEREBY EASING PROBLEM OF CAPITAL INVESTMENT, INEXPERIENCED OPERATING PERSONNEL, MAINTENANCE, AND LOSS OF FOREIGN EXCHANGE.

THE AUTHOR HAS SEEN ULTRA MODERN INSTALLATIONS OPERATING WITH UNSTABLE RESULTS PRODUCED, AND HIGH DOWN TIME FACTORS, CAUSED BY INSTRUMENTATION WHICH CAN'T BE MAINTAINED OR WHICH ISN'T OPERATING PROPERLY; AND THE VERY FACTOR WHICH WAS INTENDED TO PRODUCE EFFICIENCY IS IN EFFECT, CREATING A BREAKDOWN OF THE PROCESS.

TO ILLUSTRATE THE " SIMPLICITY " APPROACH LET US EXAMINE THE EVOLUTION OF A WASTE PAPER UTILIZATION DESIGN DIRECTED WITH CONTINUAL EMPHASIS ON SIMPLICITY, DURABILITY, RELIABILITY AND LOW CAPITAL INVESTMENT. THE BASIC PROCESS FUCTIONS WHICH SHOULD BE EXAMINED ARE SORTING, BREAKING AND CLEANING, AND PAPER MAKING.

SORTING

SORTING OF WASTE PAPER IS ABSOLUTELY ESSENTIAL. OBJECTIONABLE MATERIALS SUCH AS PLASTICS, RUBBER, LEATHER, ASPHALT, STICKS AND STONES, ETC. MUST BE REMOVED, AND THEY CAN BE REMOVED BY MANUAL LABOR. A GREAT DEAL OF TECHNICAL EMPHASIS SHOULD BE PLACED ON SORTING. NO PAPER MAKING PROCESS IN THE WORLD CAN EXIST VERY LONG IF THESE FOREIGN MATERIALS ARE NOT REMOVED BEFORE EQUIPMENT IS FOULED UP. IF BLEACHED PAPERS OR BOARDS ARE REQUIRED, SORTING BECOMES EVEN MORE IMPORTANT BECAUSE " WHITENESS " IS A VERY EXPENSIVE COMMODITY. THE OLD ADAGE THAT " YOU CAN'T MAKE A NECKLACE OUT OF A SOW'S EAR ", IS CERTAINLY APPROPRIATE IN THIS CASE.

SORTING OPERATIONS MAY TAKE PLACE UNDER SHED ROOFS TO GET OUT OF THE WEATHER, AND WALLS ARE BETTER LEFT OPEN FOR BETTER VENTILATION AND ECONOMY OF INVESTMENT.

IT WILL BE FOUND, THAT ALTHOUGH THERE ARE LABOR COSTS INVOLVED IN PROPER SORTING, IT WILL BE CHEAPER TO SEE TO IT THAT THIS IS SUPERVISED PROPERLY, THAN PERMITTING OBJECTIONABLE MATERIAL TO ENTER THE PROCESS FLOW AND THEN FIGHT TO REMOVE IT. IT IS AS MUCH AN ENGINEERING FUCTION TO UNDERTAKE THE RESPONSIBILITY FOR THIS DIRTY JOB AS IT IS TO OVERSEE ANY OTHER PART OF THE PROCESS.

BREAKING AND CLEANING

A STRONG HYDROPULPER OR BEATER IS A MUST FOR BREAKING AND DEFIBERING WASTE PAPER PROPERLY FOR THE CLEANING OPERATION WHICH MUST FOLLOW. A JUNK TRAP AND A JUNK ROPE SHOULD BE INSTALLED IF POSSIBLE AS THEY CAN REMOVE ENORMOUS AMOUNTS OF OBJECTIONABLE MATERIALS. THE HYDROPULPER CAN BE OPERATED ON EITHER CONTINUOUS OR BATCH OPERATION; CONTINUOUS OPERATION WILL YIELD A HIGHER BREAKING CAPACITY, BUT WILL MAKE THE USE OF A DEFLAKER ALMOST MANDITORY FOLLOWING THE HYDROPULPER. IN THE AUTHORS EXPERIENCE IT WILL TAKE ABOUT 5 HP PER TON PER DAY TO PROVIDE GOOD BREAKING ON A BATCH OPERATED HYDROPULPER. GENERALLY, BATCH OPERATION IS MORE DESIRABLE WITH INEXPERIENCED PERSONNEL, PARTICULARLY FOR THE CONTROL OF CHEMICAL ADDITIVES.

ABOUT 1% (BASED ON FIBER) SODIUM SILICATE CAN BE ADDED TO THE HYDROPULPER WHICH WILL HELP SEPARATE DIRT FROM THE FIBER AND INCREASE STRENGTH ON THE PAPER MACHINE. SMALL AMOUNTS OF A PITCH DISPERSANT CAN ALSO BE VERY USEFUL. IF THE WASTE PAPER CONTAINS A GREAT DEAL OF LONG FIBER, AND A HIGHER QUALITY PAPER

IS NECESSARY, THE HYDROPULPER CAN BE USED AS A SECONDARY PULPING PROCESS WITH EXCELLENT RESULTS. UP TO 4% CAUSTIC (BASED ON FIBER) IS ADDED ON BATCH PROCESS AND STEAM SHOULD BE ADDED TO APPROACH BOILING TEMPERATURE. STEAM IS EXPENSIVE - BUT THE AUTHOR HAS SEEN TIME AND TIME AGAIN, STEAM BEING BLOWN OFF AT MANY POINTS IN THE MILL INTO THE ATMOSPHERE, WHEN THIS STEAM COULD EASILY BE LEAD INTO A CENTRAL HOT WATER TANK. A NOTE OF CAUTION - CHECK VALVES MUST BE USED ON ALL LINES ENTERING CENTRAL HOT WATER STORAGE TANKS. CARE MUST ALSO BE EXERCISED TO ARRANGE FLOWS SO AS TO AVOID FOAMING. MAXIMUM EFFECT CAN BE GOTTEN FROM USING A HYDROPULPER AS A REPULPING UNIT IF THE DUMP CHEST IS MADE PARTICULARLY LARGE. THE DUMP CHEST SHOULD BE SIZED FOR NOT LESS THAN ONE HOUR'S OPERATION IN ANY CASE; THIS WILL ACT AS A BUFFER FOR THE CONTINUOUS CLEANING CYCLE AND GIVE ADDITIONAL SOAKING AND SOFTENING TIME FOR THE FIBER CLUMPS PARTICULARLY WITH CAUSTIC. A HIGH DENSITY CLEANER SHOULD BE INSTALLED ON THE DISCHARGE OF THE EXTRACTION PUMP - THIS WILL REMOVE STAPLES, GLASS, AND SMALL STONES WHICH WILL DAMAGE A DEFLAKER.

THE CLEANING CYCLE SHOULD BE OPERATED ON A CONTINUOUS BASIS. THE DUMP CHEST PUMP SHOULD PUMP THROUGH A DEFLAKER WHICH IS USUALLY NECESSARY TO PREVENT REJECTION OF USUABLE FIBER BY THE SCREENS. AFTER THE DEFLAKER, THE STOCK IS DILUTED TO HEAD BOX CONSISTENCY OF .9% IN AN ELEVATED MIXING BOX WITH WATER SUPPLIED FROM THE CIRCULATING WHITE WATER CHEST. ALL THE CONTROLS FOR THE ENTIRE CLEANING SYSTEM CAN BE GROUPED AT THE ELEVATED MIXING BOX; AND THESE CONTROLS WILL INCLUDE START/STOP PUSH BUTTONS FOR THE

PUMPS AND THE SCREENS. A VALVE EACH ON THE PULP AND WHITE WATER LINE CAN BE ADJUSTED INITIALLY AND THAN USUALLY LEFT UNCHANGED.

CENTRIFICAL PRESURIZED SCREENS ARE VERY NICE AND EFFICIENT BUT VIBRATING SCREENS ARE CHEAPER AND MUCH EASIER FOR INEXPERIENCED PERSONNEL TO OPERATE. OPEN VIBRATING SCREENS CAN ALSO BE EASILY OBSERVED AND KEPT CLEAN MANUALLY. IF A SCREEN JAMS, IT IS ONLY NECESSARY TO PRESS THE STOP BUTTON ON THE PULP SUPPLY PUMP AND CLEAN THE SCREEN. THE SCREEN PERFORATION SIZE SHOULD BE AS PER THE MANUFACTURES RECOMMENDATIONS. THE AUTHOR HAS FOUND THAT IT IS MORE DESIRABLE TO HAVE MORE SMALL SCREENS THAN FEWER LARGE ONES - THIS WILL OBVIOUSLY PERMIT THE LEAST INTERFERENCE WITH PRODUCTION WHEN BREAKDOWNS OCCUR.

THE SCREEN ACCEPTS, STILL AT LOW CONSISTENCY, WILL DROP BY GRAVITY INTO A SMALL RECEIVING TANK AND PUMPED OUT AT REQUIRED PRESSURE THROUGH LOW DENSITY CLEANERS WHICH WOULD DISCHARGE DIRECTLY TO THE THICKNERS, AND OR WASHERS. A RECIRCULATION LOOP FROM THE DISCHARGE OF THE LOW DENSITY CLEANERS BACK TO THE SCREENS ACCEPTS TANK CAN BE CONTROLLED BY A SIMPLE FLOAT VALVE SET TO MAINTAIN CONSTANT LEVEL IN THE TANK. THE LOW DENSITY CLEANER WILL THUS REMOVE SAND AND GRIT FROM THE PULP, WITHOUT ANY INSTRUMENTATION.

THERE ARE A GREAT MANY TYPES OF THICKNERS ON THE MARKET: WITH AND WITHOUT VACUMM SYSTEMS, VARIABLE SPEED DRIVES AND AUTOMATIC LEVEL CONTROLS. HOWEVER, NOTHING HAS BEEN DEVISED YET WHICH IS SIMPLER OR CHEAPER THAN THE OLD FASHIONED " SIDE HILL " THICKNER. CONSTRUCTION DETAILS FOR THIS MACHINE ARE GENERALLY AVAILABLE IN THE LITERATURE, HOWEVER, A "SIDE HILL" THICKNER IS NOTHING MORE THAN AN INCLINED WIRE HELD IN A RIDGED FRAME, WHERE UPON LOW

CONSISTENCY STOCK IS POURED DOWN THE WIRE FROM A SIMPLE WOODEN HEAD BOX. THIS SIMPLE DEVISE CAN ALSO BE USED IN SERIES AS A WASHER, WHEN CAUSTIC HAS BEEN USED FOR DE-INKING. " SIDE HILL " THICKNERS ARE COMMONLY 8 TO 12 FEET LONG AND THE FACE WIRE SHOULD BE 80 MESH. WITH THIS LENGTH AND MESH, THE CAPACITY CAN BE CALCULATED AT ABOUT 5 TONS PER DAY PER FOOT OF SCREEN WIDTH. FOUR FEET IS A CONVENIENT WIDTH, AND THIS WILL PERMIT EASY ACCESS FOR CLEANING THE WIRE.

USUALLY THE GREATEST SINGLE DIFFICULTY ENCOUNTERED IN OPERATING THE " SIDE HILL " THICKNER, IS THAT AFTER A FEW HOURS THE WIRE GETS DIRTY, THE OPEN AREA OF THE WIRE DECREASES, AND THE CONSISTENCY OF THE STOCK STARTS DROPPING RAPIDLY. TO AVOID THIS, A SMALL VERY HIGH PRESSURE (600 TO 900 PSI) PUMP SHOULD BE INCLUDED AS PART OF THE WASTE PAPER CLEANING SYSTEM, AND THE PUMP SHOULD BE EQUIPPED WITH A PISTOL TYPE FAN JET ON A HIGH PRESSURE HOSE. A REGULAR SCHEDULE MUST BE ESTABLISHED IN WHICH THE " SIDE HILL " WIRE IS THROUGHLY BLASTED CLEAN. IF THIS IS DONE REGULARLY A " SIDE HILL " THICKNER PROPERLY SIZED WILL CONTINUE TO DEWATER STOCK FROM .8% TO ABOUT 4%, AT QUITE A UNIFORM CONSISTENCY - AND WITHOUT A SINGLE MOVING PART.

FOR UNBLEACHED PAPERS THIS CLEANED WASTE FIBER CAN BE MIXED WITH VIRGIN PULP IN A PROPORTIONING BOX AND CAN PRODUCE SATISFACTORY PAPERS AND BOARDS AT GREATLY REDUCED COSTS.

IN THE CASE OF BLEACHED PAPERS, VERY SIMPLE BATCH OPERATED BLEACHING SYSTEMS CAN BE INSTALLED, USING COMBINATIONS OF DWELL CHESTS AND " SIDE HILL " WASHERS. EXCELLENT PUBLICATION GRADE PAPERS

HAVE BEEN PRODUCED IN THIS SIMPLE MANNER.

THEREFORE, IN THE TYPE OF SYSTEM DESCRIBED, EXCELLENT AND TROUBLE FREE RESULTS CAN BE ACHIEVED WITHOUT RESORTING TO HIGHLY COMPLEX AND INSTRUMENTED EQUIPMENT.

PAPER MAKING

TO GATHER THE ECONOMIC REWARD OF USING WASTE PAPER, ONE MUST BE PREPARED FOR DIFFICULTIES IN THE PAPER MAKING OR BOARD MAKING PROCESS. WASTE PAPER IS INHERENTLY A NON-UNIFORM RAW MATERIAL - OF WEAKER INHERENT STRENGTH THAN VIRGIN PULP. IT IS A MUCH SLOWER STOCK OF WIDELY VARYING FREENESS, AND USUALLY LOWER TENSILE STRENGTHS, PARTICULARY WHEN CORRUGATED WASTE IS INVOLVED. THEREFORE, REFINING FREENESS MUST BE WATCHED CAREFULLY AND MUST BE MONITORED ON A REGULAR SCHEDULE. SINCE WASTE PAPER STOCK NEEDS LESS REFINING THAN VIRGIN PULP, IT IS BEST TO REFINE THE TWO SEPARATELY AND THEN PROPORTION THEM INTO THE MACHINE CHEST. PROPORTIONING CAN ALSO BE A SIMPLE PROPOSITION; IF STOCK LINES FROM THE VIRGIN PULP CHEST AND THE CLEANED AND REFINED WASTE PAPER CHEST ARE BROUGHT TOGETHER IN AN ELEVATED DOUBLE GATE STUFF BOX, GRAVITY WILL DO A FINE JOB OF CONTROLLING THE RATIO OF THE TWO FIBERS. THE DESIRED RATIO CAN BE CHANGED AS EASLILY AS CHANGING THE BASIS WEIGHT ON A PAPER MACHINE.

IF THE STOCK IS TOO SLOW FOR THE WET END TO HANDLE, CHEMICAL DRAINAGE AIDS IN SMALL AMOUNTS CAN DO A GOOD JOB; ALTHOUGH FOAMING AND PICKING IN THE PRESSES IS ALWAYS A DANGER. SUCTION BOX COVERS WILL HAVE TO BE KEPT IN GOOD CONDITION WITH WASTE PAPER STOCK DUE TO THE HIGHER VACUMMS ENCOUNTERED.

IN THE PARTICULAR CASE OF USING WASTE PAPER FOR UTILITY PAPERS, WHERE STRENGTH IS CRITICAL, A SIZE PRESS ON THE PAPER MACHINE IS CONSIDERED BY THE AUTHOR TO BE A MUST. BY USING A SOLUTION OF STARCH AND SILICATE ON THE SIZE PRESS STRENGTH CHARACTERISTICS CAN BE INCREASED BY 25% AT NOMINAL COSTS PER TON. SOME OF THE BEST RESULTS IN STRENGTH INCREMENTS CAN BE GOTTEN BY USING 5 % LOW VISCOSITY STARCH MIXED WITH SILICATE OF SODA AND APPLIED TO THE SIZE PRESS BOILING HOT. THE RATIO OF SILICATE TO STARCH SHOULD BE EXPERIMENTED WITH AND WILL DEPEND ON THE PARTICULAR STARCH USED.

PRELIMINARY LABORATORY WORK IS INVALUABLE FOR PREDETERMINING THE CHARACTERISTICS OF VARYING THE RATIOS OF WASTE TO VIRGIN. IF TEST SHEETS ARE MADE WITH INCREMENTS OF 10% WASTE, ANTICIPATED RESULTS CAN BE EVALUATED VISUALLY, AND CURVES CAN BE DRAWN REPRESENTING PER CENTAGE WASTE VS STRENGTH. IT IS SURPRISING TO NOTE THAT SOME STRENGTH CHARACTEPISTICS WILL OFTEN RISE IN THE 30% WASTE PAPER UTILIZATION AREAS.

ACTUALLY, NOT ALL OF THE PAPERMAKING CHARACTERISTICS OF SECONDARY FIBERS ARE ON THE NEGATIVE SIDE. SOME POSITIVE CHARACTERISTICS INCLUDE: IMPROVED RETENTION OF FILLERS, IMPROVEMENT IN FORMATION IS COMMON, INCREASED OPACITY, AND OFTEN BETTER PRINTABILITY. ALL THESE FACTORS ARE DEPENDENT UPON MANY VARIABLES! BUT FROM THE SORTING PROCESS TO THE FINISHED REEL, ALMOST ALL CAN BE CONTROLLED TO ADVANTAGE BY THE VIGILANT PROCESS ENGINEER.

ECONOMIC ADVANTAGES

In one Mill with which the author has been associated the differential purchase cost of virgin and waste unbleached fiber was $ 100 a ton. Utilization of 40% waste paper saved an initial $ 40 a ton. The cost of sorting, cleaning, size press materials and amortization amounted to $ 18 a ton, leaving a net yield of $ 22 a ton of additional profit and savings in foreign exchange. The papers were completely acceptable for general utility kraft. If the waste paper had not been sorted properly, cleaned thoroughly or reinforced on the size press; the $ 40 a ton initial savings would have been illusory and unstable operations and poor quality would result in continual losses.

All the grades of paper which the Mill produces should be scrutinized carefully to determine if varying amounts of waste paper can be added without sacrificing quality. For example in one instance in a Mill producing a light blue cotton wrapper paper using semi-bleached virgin kraft pulp, the customer was asked if he would not accept a darker blue. The answer was yes. Then, 50% assorted waste paper was added with the darker blue hiding the dirt specks, the sheet was reinforced in the size press - adding strength and "rattle" - and the customer was delighted. Net savings were of the magnitude of over $ 20 a ton.

Net savings involved in the utilization of waste papers will vary tremendously according to: prices paid for the material, percentage and type used, technical characteristics of the equipment used, and the competency of personnel. As a generalization,

$ 20 PER TON OF PAPER PRODUCED, IS A COMPLETELY VALID ANTICIPATION. THIS NET YIELD ALONE WILL MORE THAN JUSTIFY THE INVESTMENT FOR CLEANING AND PROCESSING EQUIPMENT.

CAPITAL INVESTMENT

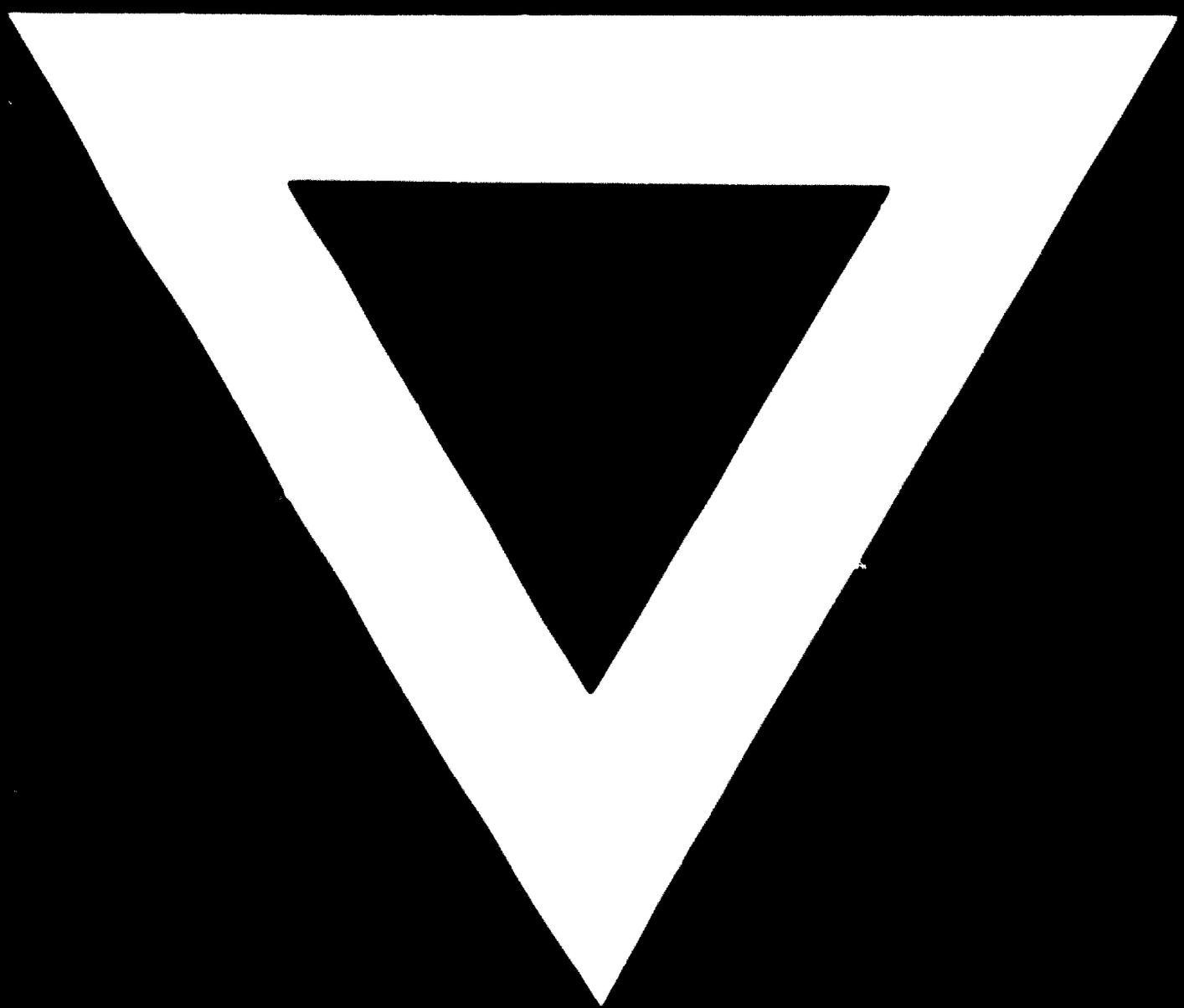
THE CAPITAL INVESTMENT REQUIRED FOR ANY PARTICULAR PROJECT USUALLY DETERMINES IT'S VIABILITY AND A HARD HEADED APPROACH SHOULD BE USED. BY ANY CRITERIA, WASTE PAPER CLEANING AND PROCESSING SYSTEMS, CAN BE AN EXTREMELY ATTRACTIVE PROPOSITION.

CAPITAL COSTS WILL OF COURSE VARY DEPENDING UPON THE EQUIPMENT SELECTED, LOCAL LABOR COSTS, AND THE TYPE OF BUILDING IN WHICH THE SYSTEM IS HOUSED. FOR A GENERAL REFERENCE OF THE COST OF A " SIMPLE SYSTEM ", A FIGURE OF ABOUT $ 3,500 TO 4,000 PER TON PER DAY CAPACITY IS A VALID WORKING FIGURE FOR A GOOD SYSTEM. THIS FIGURE CAN BE USED FOR A SYSTEM NOT SMALLER THAN 25 TONS A DAY, AND WILL DIMINISH ABOVE 100 TONS A DAY. INCLUDED WOULD BE THE HYDROPULPER, THE HIGH DENSITY CLEANER, DEFLAKER, SCREENS, " SIDE HILL " THICKNER, PUMPS, AGITATORS, CHESTS, PIPING, ETC.; ALL HOUSED IN A SIMPLE STEEL FRAME BUILDING WITH ASBESTOS CEMENT SIDING.

IF A CAPITAL INVESTMENT FIGURE OF ABOUT $ 4,000 PER TON PER DAY IS USED, IT CAN BE READILY SEEN THAT WITH A PAYPACK OF $ 20 A TON; PROPER WASTE PAPER UTILIZATION CAN BE EXTREMELY ATTRACTIVE.

IN CONCLUSION, WASTE PAPER UTILIZATION WILL BE INCREASED IN ANY AREA, UP TO REASONABLE LIMITS, WHEN THERE IS ECONOMIC INCENTIVES FOR COLLECTION AND DELIVERY TO THE MILL. THE MILL MUST BE EQUIPPED

TO USE IT, AND USE IT PROPERLY, BEFORE THE MATERIAL CAN BE PURCHASED AT AN INCENTIVE PRICE. AND THE MATERIAL CAN BE MADE VERY PROFITABLE TO A MILL, PARTICULARLY IN DEVELOPING COUNTRIES, WHEN CAPITAL INVESTMENT REQUIRED IS LOW, THE SYSTEMS OPERATE WELL WITH INEXPERIENCED PERSONNEL, AND SUFFICIENT ATTENTION IS APPLIED TO PARTICULAR OPERATING PROBLEMS.



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