PULP AND PAPER INDUSTRY AND THE ENVIRONMENT

Seminar Papers and Documents

The General Assembly of the United Nations at its 27th session late in 1972 adopted Resolution 2997 (XXVII) declaring itself "Convinced of the need for prompt and effective implementation by Governments and the international community of measures designed to safeguard and enhance the environment for the benefit of present and future generations of man".

The Resolution stated further that the Assembly was "Aware of the urgent need for a permanent institutional arrangement within the United Nations system for the protection and improvement of the human environment", and proceeded to create:

1. A Governing Council for the Environment Programme composed of 58 member countries elected by the General Assembly.

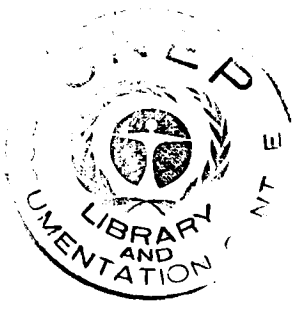
2. A small secretariat to serve as a focal point for environmental action and coordination within the United Nations system to be headed by an Executive Director elected by the General Assembly on the nomination of the Secretary General.

3. An Environment Fund to provide additional financing for environmental programmes.

4. An Environment Coordination Board under the chairmanship of the Executive Director.

UNITED NATIONS ENVIRONMENT PROGRAMME
Industry Sector Seminars

PULP & PAPER MEETING
Paris, 19-20 March 1975
Papers & Documents



UNITED NATIONS
ENVIRONMENT PROGRAMME

FOREWORD

From the first session of the UNEP Governing Council, held in June 1973, the importance of environmental issues associated with industrial development was recognized and a programme of activities on environmental problems of specific industries was initiated by the Executive Director.

A series of industrial sectors were chosen for examination by the Governing Council and the Pulp and Paper Industry is one of these sectors. Consultations have been undertaken with experts nominated by Governments, industry and international governmental and non-governmental organizations, culminating in a Seminar held in Paris in March 1975, where the state of the art of existing remedies, outstanding problems and possible avenues of research and development to resolve these environmental issues were assessed.

This report gives the Proceedings of the Seminar, which includes the background papers prepared for the Seminar, as well as all the documents presented.

The views expressed in this report do not necessarily represent the decisions or the stated policy of the United Nations Environment Programme, nor does mention of trade names or commercial processes constitute endorsement.

CONTENTS

UNITED NATIONS
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Industry Sector Seminars
Pulp & Paper Meeting
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DRAFT AGENDA

1. Introductory statement by UNEP.

2. Adoption of the agenda.

3. The environmental protection situation in the pulp and paper industry.

4. Review of pulp and paper industry's fibrous raw material situation.

5. Discussion of action needed in the following fields :

   5.1. Water

   5.2. Air and odours

   5.3. Solid waste

   5.4. Research and development

   5.5. Recovery and recycling

   5.6. Working environment and role of labour in pollution abatement.

6. Identification of constraints, or barriers to trade, investment or technology transfer caused by differing governmental environmental policies, standards, incentives, enforcement texts, etc.

7. Conclusions.

8. Other business.

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UNITED NATIONS

ENVIRONMENT PROGRAMME

Industry Sector Seminars
Pulp and Paper Meeting
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ANNOTATED AGENDA

1. Introductory statement by UNEP
   The statement will deal with the total environmental approach.

2. Adoption of the agenda

3. The environmental protection situation in the pulp and paper industry
   An introductory report has been prepared for UNEP by Mr. John E.G. Sikes, Canada. Participants may wish to have an exchange of views on this item in general.

4. Review of pulp and paper industry's fibrous raw material situation
   An introductory paper has been prepared for UNEP by the Forestry Department of the Forest Industries and Trade Division of FAO (Food and Agriculture Organization).

   Forest, as one of the most important factors for mankind's environment, plays a vital role in the pulp and paper industry as its major raw material source. The effect of the pulp and paper industry on the world's forests will be shortly discussed according to the following outline:

- the role of wood versus other fibrous raw materials in the pulp and paper industry ;
- availability of forest ;
- unconventional and new forest resources ;
- outlook for future pulpwood supply.

5. Discussion of action needed in the following fields (see also Mr. Sike's report, item 3) :

5.1 Water

Generally, the specific consumption of water (m^3 per ton) has decreased considerably in recent years. However, statistics collected recently indicate that great possibilities remain in this field ; it is significant to establish that the quantity of water used for producing one ton of the same product varies considerably from one country to another. Reduction of the amount of water used does not necessarily reduce the amount of pollutants (the concentration in the effluent increases) but it will offer appreciable savings on the external treatment.

The discharge of toxic products from the pulp and paper industry has up to now caused less attention than the much more bulky discharge of suspended solids, and of organic substances consuming oxygen. It is however, likely that legislation on this matter will gradually become more and more severe. Since the amount of products in question is relatively small it would be of interest to discuss the separation of effluents containing toxic products and their collective treatment in a central plant for detoxication.

Specifically, the following factors influencing the environmental impact of effluent discharge by the Pulp and Paper industry will be discussed :

- various pulping processes and water pollution ;
- water conservation as pollution control tool ;
- past, present and future trends in effluent treatment processes ;
- economical impact of effluent abatement ;
- monitoring techniques and their standardization ;
- effluent discharge legislation and regulations in various parts of the world ;
- international exchange of information and co-operation ;
- recommendations for action.

5.2 Air and odours

The emission of air pollutant chemicals in particle or gaseous form will be covered in general, and specifically the following items :

- impact of the pulp and paper industry's air pollution on environment ;
- present status of the air pollution abatement in the pulp and paper industry ;
- future outlook of air pollution abatement ;
- economical factors involved in air pollution abatement ;
- legislation and regulations ;
- recommendations for action.

5.3 Solid waste

Solid wastes from the pulp and paper industry, though being a much lesser problem than effluents and emissions, are causing problems to many mills.

It is to be expected that the legislation concerning wastes will become more severe in the near future in many countries. It should therefore be advisable to examine the possibilities of making use of the waste. Wood processing wastes, for instance, could be used as a source of energy or for the preparation of compost.

The following points to be discussed :

- source andnature of solid waste ;
- disposal;
- environmental impact ;
- recommendations for action.

5.4 Research and development

New, less polluting production techniques are being developed. The high cost of technology demonstration, and the risk taken by a firm which accepts to alter its production sequence for such demonstration projects, make it very difficult for a given country to undertake as many promising demonstration projects as it would wish. It would thus seem to be particularly interesting to establish, in a systematic way, an exchange of information on this item on the international level.

The identification of technology gaps and priority setting are of great importance. In particular, the following items should be considered : techniques aimed at the reduction of the colour of effluents ; techniques for the abatement of odours ; methods for dealing with sludges from effluent treatment ; treatment of toxic substances (lignins, heavy metals, processing chemicals, product additives, PCB's, inks, plastics, etc.).

In principle, the treatment requirements should be closely associated to the risks or nuisances of pollution. It is, however, difficult to establish the true determination of these risks or nuisances, in particular if the cumulative or long term effects are to be considered. Furthermore, it is much more difficult to assess, in economic terms, the cost of the damage that has been caused than the cost of construction and operation of purification plants. The assessment of risks and nuisances ought to be improved but it would nevertheless be a serious thing to delay the establishment of antipollution measures on the pretext that their necessity has not been convincingly demonstrated.

To improve understanding of potential health impacts and environmental effects of effluent discharges (suspended solids, BOD, sulphates, . . .) is an urgent task.

5.5 Recovery and recycling

In some pulping processes the chemicals used have always been recovered ; in other cases this has proved extremely difficult from a technical point of view or not profitable. The increasing severity on waste disposal and the rising prices of raw materials are two elements which make a more complete recovery desirable in future.

The search for markets for by-products has certainly to be intensified. The cost, if any, for the sale has to be compared with the cost for the safe disposal of these products, since present tendencies in waste management policy would make industry responsible for the cost of disposal.

Waste paper plays an important role as fibrous raw material for the paper industry, as well as affects the environment if not recovered. The problems involved in fuller utilization of this fibrous resource and possible solutions will be discussed as outlined here :

- the present status of waste paper recovery and utilization in the paper industry ;
- the problems hindering fuller utilization of waste paper in the paper industry ;
- recommendations for actions to increase the use of waste paper.

5.6 Working environment and role of labour in pollution abatement

It is estimated that at the present time approximately one third of pollution load comes from accidental losses, mainly due to the human factor. One solution is to install devices for automatic control. It would also be advantageous to make it clear to the workmen and employees that the control of pollution and the satisfactory operation of anti-pollution devices are equally important for the enterprise as the yield of the production.

Also, overloaded purification plants, as it is often the case, cannot work properly. Furthermore one must consider that the quality of the working environment has a positive influence on the behaviour of the workmen.

6. Identification of constraints, or barriers to trade, investment or technology transfer caused by differing governmental policies, standards, incentives, enforcement texts etc.

It seems that in most countries current legislation to combat pollution caused by the pulp and paper industry is either new, has recently been enforced, or is in the process of being modified. In general, current legislation is embodied in "outline acts", and the specific conditions for its application to various practical cases are embodied in implementing regulations which are intended to be periodically revised in relation to new requirements and technological developments. Regulatory standards are generally speaking based on the results that can be obtained by applying the best control technology currently available and economically practicable.

It is generally agreed that current regulations should be applied in their entirety to new mills from the outset of production. As regards existing plants two points must be considered : the standards to be applied and the time-table for their application. These two points should normally be settled on terms agreed upon after discussions between the industry and the authorities.

Trade implications may arise from tariffs and other trade regulations based on pollution aspects, discrimination based on pollution generated in manufacturing, government subsidies and incentives, product specifications on commodities and impact on environment.

A study covering 15 countries, carried out during 1971-1972, shows that the antipollution costs will very likely rise sharply during the coming years in most of the countries examined ; it shows furthermore that the costs vary considerably between countries for the same category of products ; the diversity can moreover be strengthened by appreciable differences in the attribution of government subsidies. However, although pollution control costs generally represent a new burden which will probably tend to be reflected in production costs, many other components determine the price of the product : raw materials and chemicals, transportation, energy, labour, capital charges, taxes, etc. These components also vary widely among countries and, subject to more detailed analysis, it would seem that the diferences are of the same order of magnitude as those appearing in the estimated pollution control costs. It is therefore questionable whether the possible

trade consequences of disparities among countries in pollution control costs can be examined in isolation, without considering at the same time all the other factors which determine the price of the product.

7. Conclusions

8. Other business

L. de Rosen - Opening remarks - Pulp & Paper Seminar - 19 March 1975

On Mr. Maurice Strong's, Executive Director of the United Nations Environment Programme, behalf, it gives me pleasure and satisfaction to open the United Nations Environmental Programme's Seminar on the international pulp and paper industry. This is the first of eight major international industry sectorial seminars which constitute a consultative process between UNEP and industry on problems of environment.

I particularly wish to welcome the truly outstanding group of international authorities and executives from governments, international agencies and from industry who have accepted our invitation to this gathering.

I must also acknowledge gratefully the generous assistance which many of you and your organizations have provided to UNEP in preparing for this complex and most important working meeting.

I bring you a personal message of welcome from Mr. Maurice Strong, Executive Director of UNEP, who had planned to be with us today but was called to a special meeting with Prime Minister Trudeau in Ottawa. Mr. Strong will fly directly to Paris tonight and will join us tomorrow morning.

Now let me describe :

1- the purpose of this meeting,
2- the UNEP's role and the policy which governs its approach, and
3- what we expect to come out of the meeting and what we intend to do with these results.

After that, I will move to the organization of work and to the time schedule and arrangements for the meeting.

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1- Our purpose in calling the meeting :

A view of the global environmental and natural resource situation inevitably recognizes the important impact of industry in all countries. It is needless to say that while industry consumes raw materials at a rising rate, it provides society with goods and services, creates wealth and trade and is a major source of employment and tax revenue and, at the same time, must control and treat its pollution. The task before this Seminar is to examine, on an international level, the very questions that concern governmental environmental bodies as well as the managements of producing companies -how can the human environment be improved and the earth's resources be used prudently, while permitting industry to make its vital contribution to society and the economy with minimum cost and disruption. We will take an overall view of environment. By an overall environmental approach, I mean one which considers air or water pollution or resource use in their broadest significance to human health, to economic and to social effects. Environment involves consideration of such larger issues as the ethic of increasing consumption of waste against conservation, of social amenities and the quality of life. It must deal with effluents at the point of production but must look also to the use and maintenance of forest resources and even to the impact of watersheds on the earth's weather system.

2- What is the UNEP's role ?

This organization derives its mandate from the Stockholm Conference on the Human Environment, from the General Assembly of the U.N. and from its own 58 nation Governing Council. In carrying out this charge, UNEP

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must work with other international organizations and, as preparations for this Seminar have demonstrated, will collaborate closely with the principal international agencies which have done such significant work in the field. Our express purpose is to complement, not to duplicate. You may ask: with so many international bodies already involved, why the UNEP ?

The answer has two aspects :

- first : the UNEP is, as far as environment is concerned, universal in representation : industrial and developing countries, free market and centrally planned economies, private and public enterprises, truly global in a field where the ultimate environmental impacts -be it the atmosphere, the water or the land- are global ;

- second : the UNEP is qualified as the Environmental Coordinating Agency for the entire U.N. system which calls for coordination cooperation, in an effort to achieve greater effectiveness and to reduce proliferation of activities. The Office of Industry working with industry will strive to bring a level of managerial understanding and competence to both these tasks and hopes that industry will join in the effort.

3- What do we want to happen at the meeting ?

As we discuss the agenda, which was drafted in concert with our industry colleagues and as the position papers are considered, we will seek to guide the discussion to identify specific points which the participants agree would advance sound environmental policy on a global scale. While it would be presumptuous to state these points now, certain examples could serve to

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direct and inform our deliberations.

How can the gathering, the classification and analysis of hard environmental information be encouraged ? Who can provide these data ?

How can they be used ?

How can advances in technology that are not strictly proprietary, be shared ? be encouraged ?

What specific steps must be taken to reach harmonization of different national policies, laws, standards and enforcement levels affecting the pulp and paper industry ? Can sets of guidelines be drafted -or suggested?

What promising technological advances in environmentally improved production offer the best promise of real breakthroughs ?

What can be done to concentrate research efforts and bring them to a "critical mass" level ?

How can cost/benefit appraisal of environmental protection measures be refined and made more realistic ?

How can environmental developments and improvements be disseminated quickly and widely ? How can the public be better informed about real environmental progress ?

What will be done with the outcome of the Seminar ?

The rapporteur will keep a record of the proceedings which will also be taped. On matters where there is agreement on needed action by governments, international agencies or the industry and its associations, a specific recommendation or finding will be noted in the record. These recommendations will be assembled, edited and approved by the end of the Seminar. They will be sent by to the UNEP's Executive Director who will submit them to the Governing Council. When approved, they will be

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submitted by the Executive Director to all governments concerned with a recommendation that they be adopted.
At the same time, the industry representatives will be requested to transmit these agreed recommendations to the industry in their respective countries. It is hoped that after local approval by companies at the board level, the national industries will also submit the recommendations to their own governments thus reinforcing the representations made by UNEP.

Now I will touch on the organization of work :

We will broadly concentrate on 4 principal subject categories :

1. environmental impacts and nuisances,
2. the development and use of new low or non-waste and low-energy consuming technologies,
3. the assessment of resource use against real needs,
4. future development of the pulp and paper industry.

In considering these broad subjects, I am well aware of the severe economic problems encountered throughout the world. Inflation, recession and unemployment and the rising cost of energy -both a cause and a result of inflation- are being faced by this and other industries. This complex of factors in turn has a marked effect on capital availability for the very growth of this highly capital intensive industry and of course for environmental and material conserving investment as well.
I want to assure our industry colleagues that we come to this table convinced of the vital importance of a sound environmental regime, but with minds open

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to the very real costs and problems faced by producers everywhere. The pulp and paper industry was selected after careful consideration including close consultation with the International Centre for Industry and the Environment which has been most cooperative. Pulp and paper was selected because, as an industry, it has an excellent record in environmental matters and has shown exemplary leadership in devising improved methods for abating environmental nuisances. While very large and very important, the industry is not as complex as certain others and this leads itself to clear and straightforward study.
It is not necessary for me to tell the Seminar industry representatives of their responsibilities -you know them well and have given the environmental issues a high priority on your policy agendas, although much remains to be done.
You realize that prudent environmental action shows the enlightened self interest which benefits management, shareholders and the public alike. Your pragmatism -often called "hard-headed"- tells you clearly that, for the industry's growth at a satisfactory pace, environmental matters must be anticipated and dealt with. Such environmental concern extends to questions of plant siting and to your role in encouraging sound forestry management to provide your raw materials.
The industry's practical experience shows the advantage and the ultimate economy of planning for least polluting facilities -the notion of doing it "right the first time".
Above all, industry performs best when it knows clearly what is expected and can count on the stability of environmental requirements. Sudden, arbitrary changes and the confusion of multiple jurisdictions impair productivity, raise costs and harm both industry and the consumer. It is axiomatic that responsible management does not like to see competitive producers "get a free ride", whether at home or abroad. For this reason, harmonization of standards -I certainly do not mean uniformity of standards- means that producers face abatement requirements that are fair while protecting the local environment. Given such a move

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toward harmonization of standards and practices, industry should welcome efforts to accelerate the transfer or exchange of knowledge and technology on environmental improvement.

Among the possible technologies for consideration are :

- use up the 50% of wood that is not transformed into pulp,
- methanol could be produced from pulp and paper manufacturing residues,
- the "dry forming process" would require no more water,
- greater recovery of sulphur values to minimize the air pollution,
- displacement of chlorine consumption as chlorine bleaching processes are increasingly replaced by oxygen bleaching to avoid water pollution,
- set up closed circuits of water circulation and recycling,
- equip the kraft plants with electrofilters (that present an efficiency of over 99%).

Pulp and paper production in developing countries :

- The average level of paper consumption in developing countries is very low with an average consumption of 2.3 kg per caput per annum of cultural papers and 3.5 kg per caput per annum of industrial papers, as compared with 56 kg and 93 kg respectively in the developed countries.
- The total annual newsprint consumption in 14 Asian countries, including India, Indonesia, Pakistan, Malaysia, Thailand, Bangladesh and Philippines, is about 600,000 tons as against some 11.2 million tons in the U.S. and 900,000 tons in Canada.

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- Developing countries possess 55% of the stocked forest land and produce only 4% of the world's wood pulp production, while developed countries, with 45% of the world's stocked forest land, currently produce 96% of the world's wood pulp supply.

Recent FAO projections of pulp and paper production and consumption trends indicate that the world is facing an increasing shortage of pulp and paper over the next several years due to shortage of manufacturing capacity. Unfortunately, the consequences of tightened supplies and rising prices will be most severe in developing countries, most of which depend on imports for a substantial proportion of their needs and have in the past been forced for economic reasons to depend on short term spot markets. To stimulate investment in manufacturing capacity in developing countries, FAO and UNDP are currently involved in a multi-phase pulp and paper industries development planning and promotion programme. However, in view of the lengthy time required to effect this investment, the programme must be viewed as a long term solution to the problem. What is required in addition is an assessment of possible measures to overcome short term shortages of critically required cultural papers in developing countries.
In recognition of this problem, the Governing Bodies of both FAO and UNESCO requested that the organizations evaluate possible ways and means of alleviating the immediate effects of the paper shortage through measures possibly including creation of a series of buffer stocks.
Also needed is an intensive and extensive programme of planning and promoting the pulp and paper industries in developing regions of the world.
On the basis of facts and figures available at FAO offices, the trend in the demand/supply situation indicates that the pulp and paper products will remain

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a scarce commodity in the developing countries and the position will be difficult in the developed countries in the foreseeable future.
The UNDP/FAO report emphasizes the use of very substantial reserves of mixed hardwood for the manufacture of pulp and paper in the developing regions through efficient and rational forest management and through appropriate technology of pulping the indigenous pulpwoods.
Dr. Bhargava recommends that, in the short term, the United Nations should appeal to the developed nations to release some essential paper supplies to the developing countries. The report also urges the developing countries, which in the past have relied on "spot and short term" paper sales, to seek long term arrangements with major pulp and paper suppliers. The report includes a preliminary list of 70 pulp and paper projects which are known to be in various stages of planning and formulation in 40 countries.

An indication of the magnitude of the task ahead is provided in a separate FAO study which says that it would be necessary to construct 150 new mills in the next 4 years to meet the projected 1978 pulp and paper deficit in the world.

Developing countries have so far failed to develop pulp and paper industries for several reasons which include the lack of technology and infrastructure together with relative inaccessibility of their forestry resources and lack of forest management and inventories, as well as shortage of capital.
Advances in the use of short fibre raw materials have increased the value of developing countries' mixed tropical hardwood forests. Dr. Bhargava's report states that the technology of using such hardwoods has only recently been

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developed to a practical and commercial level and suggests a cooperative international approach to further research on forest operations and management as well as in the pulping characteristics of the hardwood species involved.

In this respect, a major challenge facing us must be : how can sound advice be given to developing countries on how they should approach their environmental protection programme ?

The pulp and paper industry throughout the world could set as targets :

- water: remove 95% of the suspended solids in waste water through primary treatment systems, and reduce biochemical oxygen demand (BOD) by 90% through secondary systems ;

- air: maximum discharge of particulate matter would be less than 4 pounds per air dried, unbleached ton of kraft pulp (or 90% particulate removal in other processes) and maximum discharge of reduced sulphur gases would be less than 10 parts per million (dry basis) in the tail gas.

Now, let me submit some practical details about our meeting :

Hopefully, the agenda would be adopted. Time for the various topics would be allocated as shown on the blackboard. Because I insist to be your servant without putting forward any personal views, I will act as your chairman.
Mr. Sikes, who has written up the introductory report, will be your rapporteur.
In this task, he will be assisted by three international experts (Messrs. Lieben

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from OECD, Markila from FAO and Webster) and three experts from industry: Messrs. Mohatta from Nigeria, Freyschuss from Sweden and Wrist from the U.S.A.

Our rapporteurs will collect, throughout our meeting, your recommendations and findings which will be submitted to you, for approval, in the afternoon session of next Friday.

Finally, one last suggestion : I submit that, over and above brief presentations of the reports prepared for this Seminar, the discussion be brisk and give a chance to every participant to intervene : your interventions accordingly should be brief.

Again let me welcome you to what I know will be a most useful workshop on the environmental problems facing the pulp and paper industry. I ask you all to participate freely, to speak openly, to seek new and creative approaches to the problems before us. Your active intervention will insure the success of the Seminar.

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REVIEW OF PULP AND PAPER INDUSTRY'S FIBROUS RAW MATERIAL SITUATION

Introductory Paper
prepared for UNEP
by
Forest Industries and Trade Division
Forestry Department
FAO

PA.01.74-15

1. Introduction

The purpose of this introductory paper is to highlight the basic features of fibroug raw material situation of the world's pulp and paper industry today and in the foreseeable future. The estimated world production of paper and paperboard was in 1973 approximately 148 million metric tons. The main part of production was based on wood fibre, i.e. 72 per cent. Non-wood plant fibres represented about 4 percent, while the remaining nearly 24 percent was composed of waste paper.

Wood thus being the most important fibre supply source for paper and paper-board manufacture, this presentation concentrates on it. Also, the environmental aspect of the wood utilization by the pulp industry must be stressed. Wood is a renewable resource and, by proper forest management, as employed nowadays in all major pulp producing countries, overmature non-productive forests will be converted into vigorous forests which will play an important role in the world's environment. It must also be kept in mind that, because of very large investments involved in pulp and paper mills and their long life, it is the industry's interest to apply proper forest management to secure continuous supply of raw material. A document, Wood Fibre Resources and Pulpwood Requirements, was recently prepared by FAO; [1] and, because this document presents the most complete up-to-date review on the subject, it has been included as the main part of this introductory paper.

A short review of other fibrous raw material sources such as non-wood plants, waste paper, and synthetic fibres is included. Waste paper recovery is not only important as a fibre supply source, but also from an environmental point of view. Therefore, this introductory paper gives in broad terms some basic facts on today's situation, as well as forecasts of what could be expected in the future.

2. Wood

The trends of, and prospective outlook for, pulpwood requirements and, in a general way, those for other wood products against the background of world wood resources, with the view of appraising the possibilities of meeting future needs, have been examined in the above-referred FAO document Wood Fibre Resources and Pulpwood Requirements. [1]

Only the main findings of the examination have been summarized here, whereas the whole report can be found as Annex I.

2.1 Present and past pulpwood consumption pattern

Pulpwood consumption for the manufacture of wood pulp was, in 1970-72, estimated to be on an average some 403 million m^3 (solid measure). More than half of this was consumed in North America, over one-quarter in Europe – mainly northern Europe; other major users being USSR and Japan.

Over one-quarter of the pulpwood supply in the world as a whole was in the form of wood chips and residues.

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1) Wood Fibre Resources and Pulpwood Requirements, FO:PAP/74/6/Rev.1,August 1974.

An increasing proportion of non-coniferous species has been used for pulpwood. This rapid growth in the relative proportion of broadleaved specied for pulping has, of course, been made possible by technical developments in pulp and paper manufacturing processes; as well as by cost advantage over coniferous species.

Although the vast majority of pulpwood is consumed in a country – and even more in a region – where it is produced, there is nevertheless substantial interregional trade (nearly 15 million m^3 on an average in 1970-72).

The major flows have been:

1. Coniferous roundwood from the USSR to the European Economic Community (EEC) and eastern Europe.

2. Broadleaved pulpwood from eastern Europe to the EEC and from the USSR to Nordic countries.

3. Chips from North America and Oceania to Japan.

There are increasing flows of pulpwood from the USSR and of wood chips from Oceania to Japan.

2.2. Future outlook for consumption

Estimates of future pulpwood requirements, which are derived from the FAO study, Outlook for Pulp and Paper Consumption, Production and Trade to 1985, (FO:PAP/DST/71/1.1/Rev., March 1972) show that the world may need an additional 400 million m^3 (solid measure) of pulpwood for pulp production in 1985, which means nearly doubling the present consumption.

A tentative 1985 pulpwood balance, based on the assumption that the past development trends in relative self-sufficiency for pulp and paper in each region will hold, suggests that some 66 million m^3 (solid measure) of pulpwood (roundwood, chips from roundwood or residues) would be traded between wood deficit regions of Europe and Japan and the wood surplus areas of the rest of the world.

It can be questioned whether net trade levels of the estimated magnitude could develop for unprocessed pulpwood. It may, instead, be suggested that these flows might take the form of processed pulp, or even of paper and paperboard, implying a departure in self-sufficiency trends.

When estimated net trade in pulps and papers (based on past trends and converted to pulpwood equivalent) is added to the pulpwood balance, it appears that North America and the USSR would each remain net exporters of both pulpwood and of pulp and paper, that Europe would continue to be a net importer of all product groups, that Japan would remain an importer of raw wood (although it is quite possible that an increasing amount of the fibre imports will be in the form of pulp), and that Oceania and the developing regions would still be net importers of pulp and paper but would become net exporters of pulpwood.

Although the actual quantities of trade flows and the composition of these flows (i.e., whether the fibre is in the form of pulpwood, pulp or paper and paperboard) are very open to question, the developing pattern is becoming increasingly clear. It is one of growing dependency of heavily populated wood deficit areas (Europe, Japan, Asia) upon wood surplus regions.

Recent developments, e.g. shifting price structures and pressures to recycle waste paper at higher rates, as well as declining availability of pulpwood in traditional producing areas may well lead to regional variations in production costs and accelerate a shift in past self-sufficiency trends. Thus, the relative roles of North America, USSR, Oceania and the developing regions in supplying the deficits of Europe and Japan might well be debated. Where and in what form production occurs will depend on the relative economic advantages of the different regions. In the current period, with the rapid, large and wide-ranging cost and price developments, it is impossible to determine clearly what these will be. The coming period cannot but be one of intense study of production alternatives. Some idea of what these production alternatives can be from the wood raw material point of view is given in Table 12 of Annex I of the attached paper. It is sure that all alternatives will be used, but which of them will become predominant will vary over the time and will depend on the comparative costs in combination with political factors.

3. Non-Wood Plant Fibre

Resources of non-wood fibrous raw materials for pulp and paper include bamboo, bagasse, straw and other mainly annual plant fibres.

Bamboo is an established source of raw material for pulping in the Asian countries such as India, Burma and Indonesia. The estimated production of paper from bamboo in 1973 was of the order of 800000 tons and by 1985 it might go up to 1.2 million tons. On account of a short rotation, i.e. three-four years, the cultivation of bamboo can offer an attractive source of raw material in the countries where suitable climatic and soil conditions exist for growing bamboo.

In several developing countries bagasse presents an important source of fibre for pulping. The chemical pulping of bagasse is well known and has been commercially practised since 1939. The technology of commercially producing newsprint from bagasse has not yet been perfected; however, the production of newsprint is an increasing possibility.

Due to the relative low strength of short bagasse fibres, admixture of long-fibred pulp may be necessary for many paper grades. In 1973, the total estimated production of paper based on bagasse was 900,000 tons. Since bagasse may be utilized as a fuel in the sugar mills, the energy crisis could seriously restrict the availability of bagasse for pulp and paper, especially in the developing countries which have to import alternative fossil fuels.

The use of straw for making pulp and paper has limited possibilities on account of (a) collection difficulties; (b) seasonal variations in availability; (c) storage difficulties; and (d) significant reduction in the volume of straw with the development of new short-stemmed varieties of grain.

4. Waste Paper

The potential of waste paper as a fibre furnish for paper and paperboard manufacture depends on its availability and its acceptability for various grades of paper and paperboard. The availability and acceptability, on their part, are dependent on economic and technical factors.

Availability of waste paper is directly connected with paper and paperboard consumption. However, not all paper and paperboard consumed can be collected for recycling. Paper may become contaminated, by use as tissues, or by additives, like plastic coatings, in some packaging grades; or it may be permanently conserved as books or as permanent records.

It is estimated that about three-quarters of paper and paperboard consumption could be theoretically recovered.

In 1970-72, the average world recovery rate [1] of waste paper was estimated to be some 27 percent of total paper and paperboard consumption (Waste Paper Data 1970-72), by FAO, provides further detailed information on the subject and IS ENCLOSED AS Annex II). This would seem to imply that there still is a great potential for increasing the recovery of waste paper. However, several economic and technical factors limit considerably the potential for increasing the recovery.

To date, financially viable waste paper recovery operations have been based on large population centres. The expansion of collection outside population centres will result in rapidly increasing costs. At the moment, recovery is concentrated on the best quality of waste paper. Expansion of collection will result in increased sorting costs due to the poorer quality of waste paper which has to be handled.

The combination of lower quality and higher prices for waste paper presents serious reservations regarding the continued growth rate of paper recycling. In addition, the competitive uses of waste paper for other purposes than paper and paperboard manufacturing will limit the availability of waste paper. For example, the removal of waste paper from solid waste would result in a requirement of substitute energy when disposing solid waste by burning for power generation, which has probably become more attractive due to recent energy cost increases.

The proportion of waste paper fibres in the manufacture of paper and paperboard depends on the grades produced. From the technical point of view some paper and paperboard grades can be entirely made of waste paper, whereas in most grades only a limited portion of the fibre furnish can be composed of waste paper fibre. Furthermore, with the increased use of short-fibre pulp, mechanical pulps and higher yield chemical pulps, the quality of available waste paper is being lowered, thereby affecting the proportion of waste paper acceptable in the furnish of some papers.

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1) Based on data from 13 countries representing some 73 percent of the world's paper and paperboard consumption. Among the countries, only Mexico represents the developing countries. No centrally planned countries are included.

The fluctuations in virgin pulp demand and supply directly influence the demand of waste paper. Consequently, the demand for waste paper has been extremely cyclical. This has made the waste paper collection, sorting and distribution, unless they are well assured of continued strength of demand and price levels of waste paper.

Waste paper prices have fluctuated in the past much more than pulp prices and considerable fluctuation has occurred even within a given year. During the most recent past, waste paper prices have increased at a much faster rate than pulp prices. This has been due to the current tight pulp supply situation.

The country-to-country variations in the structure of paper and paperboard consumption and production also affect the use of waste paper. For example, countries like the Federal Republic of Germany, France, the Netherlands, Japan, and USA, which produce only a portion of their paper and paperboard requirements and meet the rest by imports, cannot use all the waste paper which could be recovered without considerably reducing the quality of the products. On the other hand, the major net exporting countries of paper and paperboard (Canada, Finland, Norway, and Sweden) which have rather small local consumption of paper and paperboard in relation to the production, despite the use of all recoverable waste paper, would still have a relatively low portion of waste fibre in their products. It is also doubtful whether these countries would be willing to increase the waste paper content in their products at the cost of product quality, even if it would be possible by importing waste paper. Furthermore, the obvious cost disadvantage of imported waste paper fibre in relation to the virgin pulp available in these countries would make large waste paper imports unrealistic.

In 1970-72, the waste paper consumption rate was about 24 percent, i.e. the quantity of waste paper in relation to the total fibre used in paper and paperboard manufacture. 1)

An increase of the consumption rate by only one percentage unit, e.g. from 25 to 25, would mean in the world as a whole s saving of more than one million tons of virgin pulp. This indicates the importance of increasing the share of waste paper in the fibre furnish. In case the consumption rate were increased during the next five years by one percentage unit per annum, it would mean a virgin pulp saving of some 7 million mt, and this would mean that, on an average, about 40 percent of the total recoverable quantity of waste paper in the world should be collected. This would mean an increase in waste paper collection from the present level of some 36 million mt to some 57 million mt, or approximately by 56 percent, in the next five years. Would the collection enterprises and organizations and the paper and paperboard industry be able to handle this additional quantity in 1980? Can, for example, USA increase its waste paper content in paper and paperboard by some 25 percent in the next five years? Would the consumers be ready to accept the reduced quality of final products at nearly the same price as at present for higher quality products? And especially, how would the reduced strength of packaging grades affect the compettitiveness of paper and paperboard packaging products with plastic based products?

. . . .

1) Waste paper as arrived to the paper mills; the percentage of waste paper fibres entering the paper machines is naturally smaller due to cleaning and sorting losses.

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

ORGANISATION DES NATIONS UNIES POUR L'ALIMENTATION ET L'AGRICULTURE

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WOOD FIBRE RESOURCES AND PULPWOOD REQUIREMENTS

By the Secretariat

WM/E8960

Introduction

Recent developments in world commodity markets - the intense demand for sawnwood in part of 1972-1973, the resultant rapid increases in sawnwood and log prices, the impact of these increases on wood supplies to other industries including the pulp and paper industry, the tight demand-supply situation in that industry as well as the direct and indirect impacts of rapid shifts in other commodity prices, especially oil - have refocussed attention on the supply of wood raw materials. It is the purpose of this paper to examine the trends of, and the prospective outlook for, pulpwood requirements, and in a general way those for other wood products, against the background of world wood resources, with the view of appraising the possibilities of meeting future needs. Consideration, although necessarily of a preliminary nature, will be given to developments in costs and prices of wood.

Patterns and trends in pulpwood consumption and supply

A recent publication of FAO/ECE examines in some depth the consumption and supply of pulpwood 1/ for countries of ECE membership - European countries, the USSR, Canada and U.S.A. This paper will draw on, and update the findings of that study.

The statistical problems of determining the detailed pattern of pulpwood consumption and supply are outlined in Annex I, while Annexes II, III and IV show by regions and for major countries, available data on reported consumption and roundwood removals, as well as estimated consumption derived by applying appropriate conversion factors to production of woodpulp by type and of fibreboard and particle board. The following summary table (Table 1) shows an arbitrary estimate of world pulpwood consumption, taking into account the data shown in these Annexes.

Of the total world "pulpwood" consumption, nearly 15 percent is used for manufacturing fibreboard and particle board rather than woodpulp. In the EEC, the share of these wood-based panels is more than two-fifths; in the Federal Republic of Germany it is more than one-half. In the relatively wood-rich primary producers, Northern Europe and North America, the portion is small but the same is also true of wood-deficient Japan.

Wood chips and residues, with their rapid growth in consumption, now account, in the world as a whole, for considerably more than one-quarter of the total pulpwood supply, in many countries about one-third, and in Japan well over half.

The vast majority of pulpwood is consumed in the country, and even more in the region, of production. Nevertheless, the inter-regional trade shown in Table 2 is substantial. It is worthy of note that one-sixth of Russia's roundwood pulpwood harvest is exported from the country and that Japan imports 15 percent of her total pulpwood consumption while the EEC imports from outside the region one-eighth of her pulpwood requirements.

The major flows are coniferous roundwood from the USSR to EEC and eastern Europe; broadleaved pulpwood from eastern Europe to the EEC and from the USSR to nordic countries; and residues, chips and particles from North America to Japan. Although there have been rapid intra-regional developments in pulpwood trade over the past five or six years, particularly in relative terms, the really significant changes have been the development of the chip exports from North America to Japan.

1/ Pulpwood in the current FAO definition includes wood, round or split and chips and particles for use in manufacturing woodpulp, fibreboard and particle board.

TABLE 1 - ESTIMATED PULPWOOD CONSUMPTION

Annual Average 1970 - 1972

REGION AND COUNTRY	Total Consumption			Consumption for Fibreboard and Particle Board	Consumption for Woodpulp
	Roundwood and split	Chips and Residues	Total		
	millions of m^3				
WORLD	329	124	453	50	403
NORTH AMERICA	158.0	71.0	229.0	13.5	215.5
USA	110.0	50.0	160.0	12.0	148.0
Canada	48.0	21.0	69.0	1.5	67.5
EUROPE	104.5	30.0	134.5	26.5	108.0
Northern Europe	56.0	14.0	70.0	4.8	65.2
Sweden	29.0	8.0	37.0	2.7	34.3
Finland	20.0	5.0	25.0	1.3	23.7
Norway	7.0	1.0	8.0	0.8	7.2
EEC	22.6	9.4	32.0	13.3	18.7
France	7.5	2.5	10.0	2.9	7.1
Germany, F.R.	8.0	3.5	11.5	6.0	5.5
Italy	3.0	2.0	5.0	2.1	2.9
Others (6)	4.1	1.4	5.5	2.3	3.2
Other Western Europe	11.1	2.1	13.2	2.8	10.4
Austria	3.5	1.5	5.0	1.2	3.8
Others (5)	7.6	0.6	8.2	1.6	6.6
Eastern Europe (7)	14.8	4.5	19.3	5.6	13.7
USSR	28.0	4.0	32.0	3.0	29.0
ASIA	22.0	16.0	38.0	3.3	34.7
Japan	16.0 a/	15.0	31.0	1.8	29.2
Others	6.0	1.0	7.0	1.5	5.5
OCEANIA	3.6	1.9	5.5	1.0	4.5
LATIN AMERICA	8.5	0.5	9.0	1.5	7.5
AFRICA	4.2	0.3	4.5	0.5	4.0

a/ Approximately 9 million m^3 of domestic roundwood removals are chipped before delivery to mills.

TABLE 2 - MAJOR INTER-REGIONAL TRANSFERS OF PULPWOOD 1/

Annual Average 1970-1972

REGION AND COUNTRY	Roundwood and Split	Chips and Residues	T O T A L
	Millions of m^3		
NORTH AMERICA	-1.0	-3.9	-4.9
Canada	-1.6	-2.0	-3.6
U.S.A.	+0.6	-1.8	-1.2
EUROPE	+5.0	+1.0	+6.0
Northern Europe	+1.3	+0.6	+1.9
EEC	+3.4	+0.4	+3.8
Other Western Europe	+1.4	-	+1.4
Eastern Europe	-1.1	-0.1	-1.2
USSR	-5.6	-0.7	-6.2
JAPAN	+1.0	+6.3	+7.3

1/ A minus sign indicates a net export, while a positive sign indicates a net import balance.

TABLE 3 - APPROXIMATE MAJOR INCREASES IN PULPWOOD PRODUCTION

Addition in Annual Average 1964-1966 to 1970-1972

REGION AND COUNTRY	Round and Split (from Removals)	Chips and Residues (Mainly from Residues)	TOTAL	REMARKS
	Millions of m^3			
WORLD	74	49	123	
NORTH AMERICA	28	36	64	Includes 4 million m^3 of chips exported to Japan.
Canada	4	9	13	
USA	24	27	51	Predominant removals increase is non-coniferous
EUROPE	22	10	32	
Northern Europe	11	4	15	Removals increase largely coniferous wood in Sweden
Rest of Europe	11	6	17	Much of removals increase was from France (largely non-coniferous) and Germany, F.R.
USSR	13		13	
JAPAN	7 a/	3	10	
ALL OTHERS	4			

a/ Largely chipped before receipt at mill.

Table 3 shows major increases in pulpwood production in the six year period from 1964-66 to 1970-72. It is interesting that in Europe, while in the five year period 1959-61 to 1964-66 broadleaved roundwood increase was most important, the more recent period brought more the greatest increase in coniferous species, with Sweden accounting for a good portion of the change. Wood residues continued to contribute a large share of the increase in all regions but relatively more in North America and Japan, partly because many European countries were already using a large proportion of available residues. Much of the increased Japanese supply of chips was from North American residues.

Future pulpwood requirements

Estimates of future pulpwood requirements are derived from the FAO study "Outlook for Pulp and Paper Consumption, Production and Trade to 1985" (FO/PAP/DST/71/1.1/Rev., March 1972). These wood requirement estimates are based on estimates of wood-pulp production by region and these in turn are based on estimates of paper consumption and paperboard production and on trends in self-sufficiency ratios for the pulp furnish. The paper and paperboard production estimates were similarly based on paper consumption estimates and on trends in self-sufficiency for paper and board. However, the production estimates were also reduced by consideration of the constraints of limited profitability and reinvestment, related to cost inflation exceeding price changes. One provision underlying the outlook estimates was that wood raw material resources would not become limiting.

Wood requirements, of course, do not reflect directly paper consumption estimates because of the substantial intra-regional trade in paper, paperboard and in wood-pulp. Production levels estimated by the study for the major regions on the assumption of a continuation of past trends in relative self-sufficiency, suggest the pattern of inter-regional trade in wood-pulp, paper and paperboard. By 1985, it is indicated that western Europe may be a net importer of more than 10 million m.t. of pulp and paper, eastern Europe a net importer of 2.7 million m.t. and the developing regions of the world, more than 5 million m.t. This would be supplied mainly by North America and, to a considerable lesser extent, by the USSR. Japan, Oceania and South Africa would be roughly in balance. With the exception of Japan, which is still foreseen as a very substantial importer of logs and wood chips, these trends in pulp and paper trade reflect the wood scarcity or abundance, at least for the industrialized parts of the world.

Recent developments may (1) put strain on some of the underlying assumptions of that study (e.g. income growth rates or, because of pressures to recycle waste paper at higher rates, the wood-pulp furnish ratio) and (2) suggest that trends in costs and prices may change substantially. Indeed, one possible effect of development may be regional variations in production costs and a resultant departure from past self-sufficiency trends. Nevertheless, in the absence of any more up-to-date study and in the face of the high degree of uncertainty facing the entire economy, there appears no obviously better alternative to accepting wood requirement based on estimates of future wood-pulp production of the earlier study, as a test pattern against which wood supply possibilities might be measured.

Hence, the critical question becomes: will the forests of the various regions be able to supply adequate fibre for the pulp production levels suggested for these regions?

Table 4 compares 1970-72 pulpwood consumption for woodpulp with the 1985 estimated requirements for the projected woodpulp products. Annex III gives the details of wood-pulp production and outlook. Some minor regrouping of countries and regions shown in Table 1 is presented in Table 4 in order to conform to the pattern of the study. From this table it emerges that the world may need an additional 400 million m^3 in 1985, nearly twice the amount in that year as the 1970-1972 average. Let us now consider how the expanding requirements and the prospective demand for pulpwood relate to the total wood supply situation.

TABLE 4 - RECENT AND PROSPECTIVE PULPWOOD REQUIREMENTS FOR WOODPULP ONLY

1970-1972 and 1985

REGION AND COUNTRY	1970-72 Consumption	Estimated 1985 Requirements
	million m^3	
WORLD	403	801
NORTH AMERICA	216	363
EUROPE	108	209
Western Europe	94	175
Eastern Europe	14	34
USSR	29	76
JAPAN	29	81
OCEANIA AND SOUTH AFRICA	8	18
LATIN AMERICA	7	23
OTHER ASIA AND FAR EAST	5	29
OTHER AFRICA	1	2

The expansion of pulpwood supply

Interesting trends are illustrated by world statistics on the growth of forest products output from 1959-61 to 1969-71. During this ten-year period pulpwood removals grew by 71 percent while sawlog and veneer log removals grew by only 18 percent. With the slower growth of sawlogs and veneer log removals and an actual decline of 2 percent for pitprops, poles, etc., all industrial wood removals showed an expansion of only 24 percent. Fuelwood output grew even more slowly at only 10 percent, so that the total wood harvest increased by only 17 percent. Most striking, however, is the fact that the combined output of wood-pulp, fibreboard and particle board expanded by 88 percent considerably faster than pulpwood removals (wood-pulp by 74 percent, fibreboard 81 percent and particle board, from a fairly low level, by 602 percent).

The primary reason for the more rapid growth of processed output is that additional raw material came from plant residues and was not reflected in figures on removals. In Europe, for example, use of wood residues increased from an estimated average of 5 million m^3 in 1949-1951 to 13 million m^3 in 1959-1961 and to 30 million m^3 in 1969-1971. Furthermore, recent developments in profile sawing, e.g. the "chip and saw" machinery, have lead to a larger portion of raw material, initially going through sawmills, being directed to wood chips. In fact, there has been a change in policy from using residues from wood-using plants to one of the planned joint use of raw material. The supply of this added source of raw material to industry with little or no additional drain on the forest, must

ultimately be limited by the maximum level of residue recovery and thereafter can expand only as sawnwood, veneer, plywood and other basic wood-using industries expand. The extent to which this point is being approached or has been reached in some countries is considered later in this paper. It is, however, already ominous that while an increase of 31 percent in world pulpwood removals from 1959-61 to 1964-66 was accompanied by a 40 percent increase in total wood-pulp, fibreboard and particle board output, in the next five-year period a further increase of 30 percent in pulpwood removals resulted in an increase of only 34 percent in processed output.

Another major change continuing into the decade of the 1960's, has been the increased proportion of non-coniferous species used for pulpwood. In 1950, United States, then in the forefront of hardwood pulping, used only 14 percent of its round pulpwood in the form of broadleaved or hardwood species. By 1972, this share had grown to 29 percent. The growth of this species group has been even more striking in other areas. In Japan, with heavy use of domestic hardwoods both in the round and as chips from roundwood, as well as chips from industrial residues from both domestic and imported hardwood logs, the share of hardwoods increased from 15 percent in 1956 to 58 percent in 1970. In the wood deficient, small wood-pulp producers Belgium and Hungary, the proportion of non-coniferous roundwood pulpwood consumed was, by 1972, 50 and 67 percent respectively. Even in the nordic countries of Finland, Norway and Sweden with predominantly coniferous forests, hardwood pulpwood removals grew from less than 3 percent of total pulpwood removals in 1950 to more than 16 percent in 1972. The rapid growth in the hardwood component of removals reflects the increasing use of these species not only for wood-pulp, but also in particle board manufacture.

This rapid growth in the relative proportion of broadleaved species for pulping has, of course, been made possible by technical developments in the pulp and paper manufacturing processes. But it has been abetted by prices of standing hardwood timber, lower than those of coniferous species, which despite higher logging and handling costs for the hardwoods, have allowed mills to secure cheaper wood supplies. Together with the greater pulp yields possible, this has permitted pulp manufacturers to provide short-fibre pulps at lower prices than long-fibre pulps. As the short-fibre hardwood pulps are adequate, and for some uses preferable, they have been in heavy demand by paper manufacturers. Also many hardwood species are excellent raw material for dissolving pulps.

The expansion of the short-fibre share in wood-pulp will inevitably be limited by a number of factors. There is an upper limit, economic and technical, to the proportion of this type of pulp for some uses because of the strength characteristic. As the demand for hardwoods grows, their relative cost advantage will tend to decline. Indeed, in some areas it appears to have already done so. There is, of course, a limit to available hardwood supplies and in some temperate countries, which had earlier essentially stopped increase of coniferous pulpwood production, the hardwood limit has now been reached or will be in the near future.

Over the past two decades the expansion of pulpwood supplies has been greatly assisted by technical and economic developments permitting the use of large and increasing amounts of residue and a rapidly augmented share of non-coniferous species. In view of the declining possibilities of great additional quantities of residues and because of the narrowing of the economic advantages of non-coniferous species, the question can well be raised as to whether future supplies can match expected consumption expansion without a substantial shift in the trends of the supply pattern. Must industry draw on new sources of wood additional species, different areas of production, new plantations? Are substantial increases in the cost of pulpwood relative to the price of the product and of other prices, in general, necessary to bring out the additional requirements? In an attempt to provide partial answers to these problems, the forest resource situation and the requirements for wood of all assortments will be reviewed.

Wood requirements to 1985

The series of tabular presentations that follow express in an approximate fashion the recent world situation and a suggested "model" for 1985 of wood supply and utilization. The various components of the 1985 model have been developed simultaneously to make possible a world balance with components drawn from a wide variety of national, regional and commodity group studies estimating future demand and supply situations for forest products 1/. The tables reflect quite faithfully most aspects of these appraisals. Where alternative or conflicting projections have been available the elements of these tables have been drawn from a central position. The 1985 model does, of course, make use of the projections from the FAO pulp and paper outlook study. It must be pointed out that the model is presented as a possible solution in order to identify problem areas and that it might be varied considerably, not only in terms of magnitude of growth in consumption and supply but also with respect to relative supply positions of the various regions, both in quantities and degree of processing at source. The position of pulpwood will be highlighted in the presentation and the roundwood removal estimates will be checked against resource data.

Table 5 presents the 1970-1972 situation on world wood removals excluding fuelwood and a corresponding suggested situation for 1985. These removals figures assume very substantial inter-regional trade to satisfy projected consumption but do not necessarily imply the degree of processing of the products traded. Over the 14-year period it is suggested that log removals - for producing sawnwood, veneer and plywood as well as sleepers - will increase for the world as a whole by about 25 percent, an average annual increase of 1.7 percent, slightly lower than the 1.8 percent of the 1960's. Pulpwood removals for wood-pulp, fibreboard and particle board on the other hand are seen to increase by about 117 percent, an average annual rate of 5.7 percent, nearly equal to the rate of the 1960's. Removals for other purposes - pitprops, poles, posts, etc. - as projected, show practically no growth, with declines in the industrialized regions offsetting modest growth in developing regions.

Fuelwood is excluded from Table 5. However, it should be pointed out that there has been a gradual and consistent decline in the use of fuelwood in Europe and North America and much of this has been available as transfers to pulping. It is distinctly possible that the rapid increases in oil prices and the subsequent pressures on other fuels will once more bring fuelwood into prominence as a commodity in developed economies. In the developing regions fuelwood consumption has continued to expand but only in few instances does this imply any impact on wood for pulping.

There are, of course, very substantial differences in the indicated rates of growth of removals in the different regions.

1/ See Bibliography

TABLE 5 - PRESENT AND ESTIMATED FUTURE REMOVALS OF INDUSTRIAL WOOD

REGION AND COUNTRY	Actual 1970-1972 Logs	Pulpwood	Other	TOTAL	1985 (Estimate) Logs	Pulpwood	Other	TOTAL
			Millions m^3					
WORLD	777	312	188	1,278	983	677	210	1,870
NORTH AMERICA	284	144	14	442	300	290	15	605
EUROPE	147	96	29	272	170	180	20	370
Western	106	83	15	204	125	150	11	286
Eastern	41	13	14	68	45	30	9	84
USSR	165	34	96	295	180	85	100	365
JAPAN	28	15	2	45	33	35	2	70
OCEANIA & SOUTH AFRICA	18	7	1	26	30	19	1	50
OTHER ASIA	84	4	34	122	150	35	50	235
OTHER AFRICA	16	1	12	29	40	8	17	65
LATIN AMERICA	35	8	3	46	80	25	5	110

Wood removals and forest resources

In Table 6 the average annual wood removals of 1970-1972, as well as those estimated for 1985, are compared with the growing stock and with the estimated growth of the forests. It should be pointed out that for the developing regions estimates of growth are almost meaningless because of the fact that most wood volume is in the form of unmanaged mixed tropical forests where growth tends to be offset by decay. Here, the ratio of removal to growing stock is a better indication of cutting intensity than is any comparison with estimated growth.

It will be noted that for all regions the 1970-1972 removals are considerably below estimated growth levels but that for western Europe, Japan and Oceania-South Africa they come closest to approaching growth. This is also reflected in the figure for removals expressed as a percentage of growing stock.

For the USSR and the developing regions the ratio of removals to growing stock is very low indicating the relative low intensity of cutting. However, in the more populated parts of the USSR and in many developing countries the situation is vastly different than the regional average. The low percentage of the developing regions as a whole results both from the existence of large and relatively inaccessible areas and from the fact that frequently only a small proportion of the volume occurs in sizes and species which have as yet been accepted in trade.

For Japan, the domestic forest resources have already become quite inadequate. Nevertheless, intensive forestry practices, of both natural forest and plantations, will permit by 1985 substantial increases in pulpwood removals, but imports of forest products in either raw or processed form, probably both, must grow rapidly to meet expected demands.

For Europe, the estimates of removals in 1985 shown in Table 5 need to be scrutinized carefully. Although substantially higher imports of processed products and raw wood have been assumed, removals are projected at 100 million m^3 above the 1970 level. A 1972 enquiry made by FAO of European forest services provided national estimates of felling forecasts to 1980. The totals showed an expected increase of 15 million m^3 of large sizes and 44 million m^3 of small sizes. The increases were largely concentrated in Sweden, France, Spain, Turkey and Finland. An extension of these increases to 1985 would suggest expansions in the 15-year period from 1970 of 22 and 66 million m^3 and a shortfall of 10 to 20 million m^3 from the figures shown in Table 5, which would have to be met by yet further imports. However, this is a relatively small portion of the total involved. It is, nevertheless, clear that Europe must move more and more into a deficit position with respect to regional supply of most types of forest products.

Although Oceania and South Africa appear from Table 4 to be approaching a critical situation by 1985, this is not so. Under current afforestation plans this region will have at least another 1 million hectares of fast growing plantations by that time adding some 15 to 20 million m^3 to the regional annual increment.

For 1985, the percentage values in Table 6 still remain small for the developing regions. This does not reflect adequately the fact that increased quantities of conventionally accepted species and qualities of logs, which have made up a large share of their removals, will become more and more difficult to obtain and that shifts to other assortments will be necessary.

North America is in an intermediate position in respect to magnitude of removals in relation to growing stock. Here the considerable regional differences are important. The relative situations in coniferous and non-coniferous species are also quite diverse.

A closer look at regional, species and log size aspects is necessary to appraise the position of all regions adequately. Lack of data and space preclude a detailed analysis. However, some important highlights are worthy of note.

Tables 7 and 8 examine for coniferous and non-coniferous species respectively, the relation of 1972 removals, including fuelwood, growing stock and growth.

TABLE 6 - PRESENT AND PROSPECTIVE WOOD REMOVALS

AND THEIR RELATIONSHIP TO FOREST RESOURCE

REGION AND COUNTRY	Removals (excluding fuelwood)		Estimated growth b/	Estimated growing stock b/	Removals of percent of growing stock c/	
	Average 1970-72	1985			1970-72	1985
	..... Millions of m^3				%	
WORLD	1,278	1,870	(3,200)	(306,000)	0.5	0.7
NORTH AMERICA	442	605	951 a/	36,100	1.3	1.9
EUROPE	272	370	435	13,300	2.2	3.1
Western	204	286	325	9,000	2.5	3.5
Eastern	68	84	110	4,300	1.8	2.2
USSR	295	365	844 a/	73,200	0.5	0.6
JAPAN	45	70	77 a/	1,900	2.6	4.1
OCEANIA & SOUTH AFRICA	26	50	45	1,400	2.1	4.0
OTHER ASIA	122	235	(400)	(34,000)	0.5	0.8
OTHER AFRICA	29	65	(100)	(22,000)	0.1	0.3
LATIN AMERICA	46	110	(400)	(124,000)	0.05	0.1

a/ For Canada, USSR and Japan growth is net growth, for other developed countries gross growth.

b/ With bark.

c/ Growing stock is reduced by 10 percent as a bark allowance.

Coniferous forest resource and removals

From 1959-1961 to 1972 world removals of coniferous wood increased by 162 million m^3 (18%) to 1,109 million m^3. Roughly half of the increase occurred in North America, while Europe and the USSR each accounted for one-fifth. For the world, as a whole, coniferous fuelwood removals stayed fairly constant at about 175 million m^3. Sawlog and veneer log removals accounted for more than 100 million m^3 of the 12-year increase, with 75 million m^3 of this occurring in North America and 20 million m^3 in Europe. During the same period, removals of coniferous pulpwood and pitprops increased by only 35 million m^3, although this figure is a low indicator of pulpwood increase because of a decline in pitprop production and the fact that pulpwood output in 1972 was down from earlier highs.

An examination of Table 7 shows that the coniferous forests of the world are quite heavily utilized. Only in the USSR and Canada, and possibly the United States, does there appear to be any very substantial increase in the level of removals without pressing hard on the cut-growth ratio.

The felling forecasts for Europe referred to above, show considerable increase from 1970 coniferous cutting levels to those of 1980 (some 40 million m^3). The great bulk of this was expected in northern Europe (largely Sweden as the result of new inventory information and Finland as an effect of forest investment). Germany is also expected to contribute substantially to expansion, as young plantations mature. It appears, however, that any appreciable further expansion must depend on considerable new investment in the forest.

Published data on the Japanese long range prospects appraisal does not distinguish between coniferous and non-coniferous forest and output. However, an examination of resource data suggests that increase in removals might be more in coniferous species, despite about equal volumes of resource in the two groups, because of the better quality of the coniferous stands.

The USSR, with about three-fifths of the world's coniferous wood volume and producing less than one-third of the coniferous wood forest, has the greatest physical base for expansion of coniferous removals. However, the European portion of these forests is already heavily exploited. From this region, which contains only one-third of the coniferous forest area of the USSR, comes more than 80 percent of all removals. Any major expansion must be from the forest east of the Urals. In describing the future of the eastern region, Professor I.V. Vassiliev, the senior authority on the USSR forest resource, has this to say: "In the Far Eastern regions, there are still great possibilities for the extraction and processing of timber, without advancing northwards.

.... in the USSR beyond the Urals, the region which possesses the largest high-quality raw timber potential for the development of the timber industry is eastern Siberia. This is the area, therefore, in which the largest and most important timber processing centres are being and will be constructed (the combines at Bratsk and Krasnoyarsk, the projected plant at Verkhne-Lensk, and others). This region is on the way to becoming, and will remain, one of the main timber producing and extraction regions of country-wide importance, destined to supply the USSR as a whole, and Central Asia and Kazakhstan in particular, with the timber and timber-based products they need.

Since local timber requirements in the Far East are relatively limited, one major factor in the development of timber extraction in this region will be the prospects for exporting large quantities of roundwood, specially made chips and other timber processing products to the countries of the Pacific.

An increasing amount of the timber extracted in Siberia will be processed on the spot to produce sawnwood, plywood, paperboard, paper, panels, and so on. In 1975, according to the plans which have been adopted, Siberia and the Far East will supply 34 percent of the total volume of removals, 32 percent of the sawnwood, 16 percent of the plywood, 14 percent of the wood-based panels, 20 percent of the paperboard and 15 percent of the paper; and

these proportions may be expected to increase still further in the course of subsequent decades. Clearly, these forests will contribute more and more to the world's wood consumption, Only the rate of development is in doubt."

In North America, and especially in Canada, the coniferous forests are much more heavily exploited than are the broadleaved forests. In the United States some considerable further potential remains despite a developing shortage of sawlog size material. The recent study "The Outlook for Timber in the United States" estimates possible coniferous supply increases of 32 million m^3 from 1970 to 1980 and a further 16 million m^3 to 1990. These increases are considerably less than those of the hardwood species. The largest expansion is expected in the South, while in the Pacific Coast region coniferous removals are foreseen to decline slightly. In Canada, substantial coniferous reserves remain in the interior of British Columbia and in the northern parts of Ontario and Quebec. In the North American region, concern over the environment and especially requirements for reserved forest recreation areas may be expected to have a limiting effect on the expansion of exploitation.

In Oceania, especially New Zealand, and in South Africa pulpwood production is heavily dependent on coniferous plantations.

Coniferous plantations are the base for pulp production in Chile, while in Brazil and Argentina they support wood supply from the natural forest.

In many parts of Africa (Malawi, Madagascar, Kenya, Tanzania, Zambia and the Democratic Congo Republic for example), and in Asia (Malaysia and Fiji, for example) plantations already established, or which may be established on the basis of already successful planting trials, are being developed or considered as a source of pulpwood for domestic pulp mill supplies or for the export of pulpwood.

Non-coniferous forest resources and removals

World removals of non-coniferous wood increased from 1959-69 to 1972 by an estimated 238 million m^3. However, 128 million m^3 of this is in the form of fuelwood, with major increases occurring in developing regions, offset to a small extent by declines in the relatively low fuelwood production of developed regions. Of the remainder - industrial wood removals - sawlogs and veneer logs made up 60 million m^3 and pulpwood and pitprops, 45 million m^3. By far the most important increase in log output was in the south-east Asia area - some 35 million m^3. The pulpwood increases were largely in the United States, Europe (northern Europe and EEC) and Japan. In all these regions, as well as in the USSR, pulpwood increases were more than offset by declines in fuelwood removals.

The present and prospective hardwood pulpwood supply situation was considered in some detail in a paper presented to the 1973 meeting of the FAO Advisory Committee on Pulp and Paper. This paper reviewed the world's temperate forests and their pulpwood potential and considered the possible need in the heavier consuming areas to draw on the mixed tropical forests as a raw material source for short-fibre pulp. The following material is largely quoted from that analysis. A comparison of Tables 7 and 8, suggests that, in Europe, hardwoods are being cut even more heavily than are coniferous. Nevertheless, there are still more than 50 million m^3 of fuelwood being cut annually. Some of this material might be diverted to pulping unless, as is quite likely, the current prices of fuels reverse the declining trend of fuelwood use.

Individual European countries which have appreciable hardwood resources and which do not appear, from a cursory examination of the data, to be making full use of them are Sweden, France, Yugoslavia, and perhaps Romania. Countries still using substantial amounts of hardwood fuelwood are Finland, Romania, Spain, Turkey and Yugoslavia.

All these countries do foresee considerable increases in removals of industrial hardwoods. However, the total increase in small sized industrial hardwood removals that is foreseen from 1970 to 1980, does not exceed 20 million m^3 for the region. As much as 5 million m^3 of this is foreseen by France alone.

The situation is, however, quite different in other regions.

The U.S. Forest Service has recently completed "The Outlook for Timber in the United States". According to the differing price assumptions made in its demand projections to the year 2000, consumption of pulpwood will rise from the roughly 70 million cords of 1970, to 130, 158 or 192 million cords by that time. The hardwood component of domestic pulpwood is expected to grow from the present 25 percent to 40 percent in 2000. For hardwood, this is the equivalent of 86 to 140 million m^3 as compared to the present 30 million m^3, an increase of as much as 110 million m^3.

The study foresees no major problem in meeting the total demand for hardwood (except for material of saw timber size) during this period. It states:

"The outlook is also relatively favourable for the pulp and paper industry since this industry can utilize small trees and low-quality material, including both plant and logging residues. Nevertheless, the pulp industry will also be directly affected by price increases for timber used by the lumber and plywood industries. Substantial amounts of saw timber size trees are cut for pulpwood. Also, price rises for higher quality timber can be expected to influence prices for all sizes and sources of pulpwood."

Forest statistics give a picture of the regional situation within the United States. For the country as a whole, hardwood growth in 1970 was estimated at 7,900 million cubic feet while hardwood removals were only 4,400 million cubic feet. The surplus of 3,500 million cubic feet is largely found in the Northeast (1,250 million), North central (1,100 million) and the Southeast (500 million). Some 1,000 million cubic feet are in oak species and a large portion of the remainder (1,500 million) is miscellaneous hardwoods not heavily used for sawnwood (e.g. soft maple, beech and poplar).

As can be seen from Table 8, utilization of hardwood in Canada is very low. Of the 3,580 million m^3 of hardwood inventory, more than half is in poplar or aspen, heavily concentrated in northern Ontario and Alberta, more than a fifth in white birch largely in Ontario and Quebec and the great bulk of the remainder in yellow birch and maple in Quebec, Ontario and the Maritime provinces. The latter species are generally more readily accessible. Until recently, these hardwoods have been little used except as sawlogs and veneer logs where quality has permitted, or as fuelwood. It does not seem unreasonable to suggest that as much as 40 or 50 million m^3 additional of hardwood species could be harvested annually by the end of the century.

Although the total removals of wood in Japan have stabilized over the past two decades, removals of hardwoods have actually decreased. Consumption levels still seem modest with respect to growing stock and growth and it might be possible to gradually raise, in a fairly short period, the domestic hardwood pulpwood production by an additional 15 or 20 million m^3 in step with the increasing trend for hardwood consumption and the possible increased imports of coniferous wood from North America and eastern Russia. The "Basic Plan on Forest Resources" and "Long-term Projection of Demand and Supply of Important Forest Products", recently adopted by the Japanese Cabinet, foresee domestic supply of industrial wood (both coniferous and broadleaved) increasing from the current 46.3 million m^3 to 49.7, 58.7 and 94.3 million m^3 in 1981, 1991, and 2121 respectively, while fuelwood production is seen to grop quite rapidly from the current 5.7 to 2.5 million m^3.

Australia has an appreciable remaining surplus of hardwood cutting potential, although it probably is largely a matter of difficult access to mill sites which has limited output. Some of this material may laready be coming available for export in the form of chips. An additional 5 or 10 million m^3 annually might be a reasonable prospect for increased hardwood pulpwood in the next decade or two.

In the USSR, there remains a large potential for expansion of hardwood output. More than half of the hardwood resource is located in the vast areas of Siberia and the Far East, while a further one-quarter is in the relatively unforested southern areas which are heavily cut with respect to coniferous wood. It is the latter more heavily populated region where

much of the sawnwood, as well as paper and paperboard, is produced, whereas much of the pulp production occurs in the North-West. Consequently, it might be expected that, should any substantial shift to short-fibre production occur, it would be in the southern areas closer to consuming centres.

K.A. Veynov draws attention to the fact that the consumption of low-quality wood and chips is increasing for pulp and paper production and estimates that hardwoods will make up 20 percent of pulpwood consumption in 1975.

With the exception of a very few countries, non-coniferous plantations are still relatively unimportant for pulpwood production compared with natural hardwood forests. Brazil, with 650,000 hectares of eucalyptus already established and annual planting proceeding at a rate of 10%, has an annual growth in the order of 10 million m^3 with a yearly increase of a further 1 million m^3. Half of the plantations are committed to existing pulp mills while another quarter is planned to support new projects. The South African plantations of 330,000 hectares have an annual production in the order of 5 million m^3 which is being expanded at the rate of 5 percent per annum. About one-quarter is devoted to pulpwood production. Eucalyptus plantations in Morocco and Argentina have each some 1 million m^3 of annual growth largely committed to pulpwood production. Portugal has production potential of about 2 million m^3 in existing plantations while both here and in Spain there is a large area suitable for planting.

The FAO paper referred to above estimates that in the next two or three decades an additional 170 to 255 million m^3 of hardwood pulpwood from temperate regions and established on planned plantations, are considered possible and adequate to meet requirements for short fibre pulp of the developed regions. However, there would need to be considerable movement of hardwood pulp or its equivalent in wood-pulp or paper into Europe and Japan.

The massive quantities of mixed tropical woods are a major potential source of raw material for wood-pulp. Considerable use may be made of this resource in most favoured locations or indirectly though residues from veneer and sawlogs, especially where markets in the developing regions are large enough to justify mill establishment. It must be realized, however, that while pulping mixed tropical hardwoods is not a technical problem, economic problems associated with harvesting and regeneration remain, in most instances, difficult to solve.

Potential Residue Utilization, 1985

Table 9 shows the regional pattern of residue use and its relationship to the logs processed for sawnwood veneer and plywood in the same regions. In 1970-1972, as much as 28 percent of utilized log volume was used as chipped residues for pulping, fibreboard and particle board in North America where utilization was most intense. In Europe the utilization level was only 18 percent, although in northern Europe it reached nearly one-third, as it did also in Canada. For the world as a whole, the recovery of residue for these uses falls far short of this level. Japan is a special case where the high yield of sawnwood and veneer -more than 70 percent- precludes the availability of a high residue yield.

For 1985, estimated log removals and a set of assumed net trade quantities are used to derive log consumption estimates and to these, in turn, is applied a set of assumed recovery rates for residue for processing. The recovery value used for North America is close to the assumed maximum of around 36 percent. This maximum rate is assumed to be approached in much, but not all, of Europe. For Japan, it is assumed that three-quarters of residue will be utilized for pulpwood. For the other regions, including the USSR, residue use has not been relatively important and no clear trends are evident. Therefore, the estimates of residue use established for these regions are made arbitrarily with some consideration of the relative scarcity of wood and of the degree of concentration and integration which is developing in the industry. The world rate is assumed to increase from 16 to 24 percent.

It should be pointed out that log trade is assumed to continue to increase, although less rapidly, in the Pacific region but that exports from North America and Africa are assumed to decline as do imports into Europe. It should also be noted that production of log removals of this magnitude in the tropical regions will call for a broad expansion in the range of species and qualities accepted on the market.

These calculations provide a model of possible residue availabilities in 1985. It is interesting to note that this projection results in an increase of only 79 percent in total volume of residue use compared with 117 percent increase for round pulpwood removals, thus reversing the growth pattern of the past decade or two.

TABLE 7 - CONIFEROUS GROWING STOCK, GROWTH AND 1972 REMOVALS

REGION AND COUNTRY	Growing Stock		Gross Growth	1972 Removals			
	Percent of total			Total	Fuelwood percent of total removals	As percent of growing stock b/	As percent of growth b/
	..... Millions of m^3					%	
WORLD	..	..	..	1,109	16	..	..
NORTH AMERICA	74	26,600	609	381	1	1.6	70
Canada	80	14,200	225 a/	109	1	0.9	54
U.S.A.	68	12,400	383	272	1	2.4	79
EUROPE	65	8,700	281	214	8	2.7	84
Northern	83	3,400	121	90	3	2.9	83
EEC	56	1,500	57	39	6	2.9	76
Other Western	73	1,600	47	37	25	2.6	88
Eastern	50	2,200	56	47	8	2.4	93
USSR	84	61,200	577 a/	319	17	0.6	61
JAPAN	48	1,000	41 a/	25	-	2.9	68
OCEANIA & SOUTH AFRICA	37	400	21	15	-	3.8	72
OTHER ASIA	..	..	..	101	77	..	..
of which China	..	..	..	81	66	..	..
OTHER AFRICA	..	..	..	7	44	..	..
LATIN AMERICA	..	..	..	45	50	..	..
of which Brazil	-	200	..	26	57	12.1	..
Mexico	..	500	11	8	36	1.5	80

a/ Net growth

b/ Growing stock and growth reduced by 10 percent bark

TABLE 8 - NON-CONIFEROUS GROWING STOCK, GROWTH AND 1972 REMOVALS

REGION AND COUNTRY	Growing Stock		Gross Growth	1972 Removals			
	Percent of total			Total	Fuelwood percent of total removals	As percent of growing stock b/	As percent of growth b/
	..... Millions of m^3					%	
WORLD	..	..	..	1,354	72	..	..
NORTH AMERICA	26	9,500	342	94	14	1.1	31
Canada	20	3,600	78 a/	11	23	0.3	15
U.S.A.	32	5,900	264	83	13	1.6	35
EUROPE	34	4,500	153	126	42	3.1	91
Northern	17	700	27	19	44	3.1	77
EEC	44	1,100	50	41	32	4.0	91
Other Western	27	600	22	23	68	4.2	121
Eastern	48	2,100	54	42	37	2.2	86
USSR	16	12,000	267 a/	64	47	0.6	27
JAPAN	48	900	35 a/	21	8	2.6	66
OCEANIA & SOUTH AFRICA	73	1,000	23	17	18	1.7	75
OTHER ASIA	..	..	..	527	78	..	..
OTHER AFRICA	..	..	..	287	90	..	..
LATIN AMERICA	..	..	..	239	88	..	..
of which Brazil	100	81,000	..	137	91	0.2	..

a/ Net growth

b/ Growing stock and growth reduced by 10 percent bark

TABLE 9 - RECENT AND ESTIMATED FUTURE UTILIZATION OF RESIDUES FROM LOG PROCESSING

1970-1972 and 1985

REGION AND COUNTRY	1970-1972					1985 (Estimates)				
	LOGS			RESIDUES		LOGS			RESIDUES	
	Removals	Net Trade	Consumption	Utilized		Removals	Net Trade	Consumption	Utilized	
	millions m^3			% of log volume		millions m^3			% of log volume	
WORLD	777	-	777	123	16	983	-	982	220	22
NORTH AMERICA	284	-11	273	75	28	300	-5	195	100	34
EUROPE	147	+ 9	156	29	18	170	+5	175	45	26
USSR	165	- 7	158	5	3	180	-10	160	25	15
JAPAN	28	+39	67	9	14	33	+45	78	15	19
OCEANIA & S. AFRICA	18	- 1	17	2	12	30	-	30	8	25
OTHER ASIA	84	-24	60	1	2	150	-30	120	10	8
OTHER AFRICA	16	- 6	10	1	10	40	- 5	35	5	15
LATIN AMERICA	35	-	35	-	-	80	- 1	79	12	15

TABLE 10 - TENTATIVE 1985 BALANCE FOR PULPWOOD REQUIREMENTS

REGION AND COUNTRY	Supply			Requirements			Balance a/
	Removals	Estimated Residues	Total	Wood for Pulping	Wood for Fibreboard and Particle board	Total	
	millions of m^3						
WORLD	677	220	897	801	96	897	-
NORTH AMERICA	290	100	390	363	22	385	- 5
EUROPE	180	45	225	209	45	254	+ 29
USSR	85	25	110	76	9	85	- 25
JAPAN	35	15	50	81	6	87	+ 37
OCEANIA & S. AFRICA	19	8	27	18	3	21	- 6
OTHER ASIA	35	10	45	29	5	34	- 11
OTHER AFRICA	8	5	13	2	2	4	- 9
LATIN AMERICA	25	12	37	23	4	27	- 10

a/ Minus denotes net export, plus net imports

TABLE 11 - TENTATIVE NET BALANCES [a] FOR PULPWOOD, PULP AND PAPER IN 1985

(In Wood Equivalent)

Region and Country	Pulpwood	Pulp and Paper	Total
	Million of m^3 pulpwood equivalent		
North America	- 5	-60	-65
Europe	+29	+40	+69
USSR	-25	- 8	-33
Japan	+37	- 1	+36
Oceania and South Africa	- 6	+ 3	- 3
Other Asia	-11	+15	+ 4
Other Africa	- 9	+ 3	- 6
Latin America	-10	+ 8	- 2

a/ Minus denotes net exports, plus net imports.

Tentative 1985 Pulpwood Balance

In Table 10, the suggested pulpwood removals for 1985 are added to the residue estimates to provide an indication of possible supply of wood for pulping and for manufacturing fibreboard and particle board, and this supply is compared with estimated requirements for those uses. The differences are shown as possible net trade balances in pulpwood, which might be in the form of roundwood or chips from roundwood or residues. These balances present an interesting array. The export balance for North America is about the same as the current level. That of the USSR increases substantially as do the import balances for Japan and Europe. All other regions show some development of net export volumes. It may well be questioned whether net trade levels of this magnitude could develop for unprocessed pulpwood. It might be alternatively suggested that these flows might take the form of processed pulp, or even paper and paperboard. If so, it would mean that the trends of continuing degree of self-sufficiency in paper and paperboard and in woodpulp production assumed as a basis for projecting woodpulp, and paper and paperboard production in the FAO outlook study, would be altered.

Table 11 adds to the pulpwood balance figures of Table 10, an approximate pulpwood equivalent of the estimated 1985 net trade in pulps and papers as developed in the paper "Outlook for Pulp and Paper Consumption, Production and Trade". This Table suggests that North America and the USSR would each remain net exporters of both pulpwood and of pulp and paper, that Europe would continue to be a net importer of all product groups, with Japan remaining essentially an importer of raw wood, while Oceania, South Africa and the developing regions, would still be net importers of pulp and paper but would become net exporters of pulpwood.

The actual quantities are, of course, very open to question as they have resulted from a series of assumptions on demand and supply formulating factors made in the studies drawn upon. Nevertheless, the developing pattern is becoming increasingly clear. It is one of the growing dependency of heavily populated wood deficit areas upon wood surplus regions.

The relative roles of North America, the USSR, Oceania and the developing regions in supplying the deficits of Europe and Japan might well be debated as all these regions could have one or more forms of additional production - more remote wood, more hardwoods, wood from coniferous or broadleaved plantations already established, from the large volumes of mixed tropical hardwoods, or increased residue salvage.

Where and in what form production occurs will depend on the relative economic advantages of the different regions. With the rapid, large and wide-ranging cost and price developments of the current period, it is impossible to determine clearly what these will be. What is clear is that there is urgent need for appraisals of various production opportunities and the weighing of one against the other. The coming period cannot but be one of intense study of production alternatives.

The Cost of Pulpwood

It may be useful to add a note on the development of pulpwood costs and prices over time.

Analysis of pulpwood prices over any long period of time is particularly difficult because of substantial shifts in utilization patterns (changing species mix, increasing proportion of residues and integrated use of raw materials), and in trade patterns. In addition, much pulpwood is harvested by firms which do the processing and consequently there are available only book-keeping values rather than market prices. It does, however, appear that over the 1950-1970 period, at least from 1952 to 1969, there was little upward movement of pulpwood prices in Europe and wave fluctuations in prices dominated as demand varied. In the United States by contrast, there was a nearly continuous modest upward trend in pulpwood prices at about the rate of prices generally and at slightly slower rates in Canada. Cost increases were controlled during this period, despite rising labour costs by a series of improvements in labour substituting machinery. Stumpage prices and public land royalty charges showed little or no upward movement and contributed to the stability. Because in this period woodpulp prices remained fairly constant, the ratio of pulpwood price to woodpulp price also followed similar patterns - rising slightly in North America and fluctuating appreciably in Europe.

By 1968 or 1969, pulpwood prices had begun to rise fairly rapidly in most regions as a result of continued rising costs of, and difficulties of obtaining labour. Pressures on prices were accentuated by heavy demands for, and rising prices, of sawlogs. In some, but not all countries, there was an easing of prices in 1971-72, partly because of surplus stocks, but the rapidly rising costs of nearly all wood prices in the latter part of 1972 and the first portion of 1973 brought renewed pressure. Pulpwood has not generally felt the relief on prices which was experienced by sawlogs in the latter half of 1973 and which has continued into 1974.

The increased prices of oil, and consequently of other fuels will, of course, have a major impact in increasing logging and transport costs and may even divert some wood to fuel purposes. How this will affect pulpwood prices in relation to prices generally is not yet readily apparent.

One thing seems reasonably clear, however. Unless further major technical improvements in logging and transportation are forthcoming, the difficulties of obtaining woods and labour, even at high wage rates, together with the necessity to go greater distances and to lower quality stands and trees or to establish plantations and improve silviculture at considerable costs, will bring about continued and substantial increases in the price of pulpwood.

Alternate sources of additional pulpwood

In conclusion, is presented a rough tabular checklist of possible sources of additional pulpwood with some indications of their relative advantages and disadvantages (Table 12). It is from among individual detailed projects falling mainly within this broad spectrum, that decisions will need to be made to determine the ultimate sources of the additional pulpwood supplies.

TABLE 12 - MAJOR NEW AND INCREASED SOURCES OF PULPWOOD

SOURCE	TYPE	MAIN AREAS	ADVANTAGES	DISADVANTAGES
I. EXISTING FORESTS				
A. Areas under management and exploitation				
(i) Increased salvage of processing residues	Conifers Hardwoods	Regions of concentrated sawmilling, veneer and plywood production and other wood-working	Supplies often near pulping locations	Utilization levels already high in areas of best opportunity, United States, Canada, Northern Europe, Germany
			Avoids disposal and pollution problems	Competition from fibreboard and particle board markets
				Cost increases rapidly with scattered small production
		See also I A (iv) C below		
(ii) Salvage additional logging residues (tops, branches, partly defective boles, stumps, etc.)	Conifers Hardwoods	Sawlog and veneer log producing regions. Large coniferous logs in Western North America, Hardwoods in United States, Europe	Supplies often near pulping locations	Apt to be very costly unless integrated operation Costs rise rapidly with smaller sizes, more crooked material, etc.
(iii) Harvest lower quality stands (less dense, poorer trees. etc.)	Conifers Hardwoods	Largely less accessible areas near margins of exploited forests	Spreads overhead costs of roads, etc	Maybe on poor sites and create reestablishment and protection problems Costs rise rapidly as quality declines
(iv) Increase species range (a)	Conifers	Limited opportunity		
(b)	Temperate Hardwoods	Eastern & Northern United States, Southern USSR, France, Yugoslavia, Australia, India	Large qualities often available	Pulping qualities may be less preferred Stands often scattered
(c)	Tropical Hardwood	West Africa, Southeast Asia, Amazon	Immense quantities available	Problems of many species of different densities leading to economic disadvantages of costing sorting of mediocre and variable quality of pulp produced
(v) Divert fuelwood	Mostly Hardwood	USSR, European countries For most pulp-producing regions little remaining opportunity	Has put wood to higher value use	Often scattered stands and costly collections Fuelwood values have improved
(vi) Increase silviculture treatment (more frequent thinning, fertilization, improved regulation stand conversion, fire protection)	Conifers Hardwood	More accessible and frequently harvested stands	Reduced transportation costs and logging overheads	Time lag in returns Declining rate of returns with intensification
B. Unexploited more remote areas	Conifers	Interior B. C. North Ontario & Quebec, Siberia, Mexico & Central America	Favoured species	Increased logging and transportation costs. For some regions, e.g Siberia, rate of development must be slow and gradual
	Temperate Hardwoods	Northern Canada Eastern USSR Australia	Large quantities available	Increased costs of logging and transportation
	Tropical Hardwoods	see above	see above	see above
II. AFFORESTATION	Conifers	Rapid Growing areas in mild temperate & in higher elevations of tropics	Concentrated and systematically planned harvesting possibilities in selected sites	High establishment cost Problem of alternate land use
	Hardwood (especially eucalyptus and poplar)	Wide growing range Many areas of tropics, mediterranean and temperate	Rapid growth, short rotation after cheap labour	Possible limit to short-fibre demand

ANNEX I

Many factors contribute to the very difficult statistical problem of determining with accuracy the patterns of pulpwood supply and consumption. Wood of the assortments used for manufacturing fibreboard and particle board is not distinguishable from wood for pulping, while wood used for fuelwood is often suitable for pulping. Wood, usually more valuable when used for pitprops, and even sawlogs and veneer logs, may find its way to pulping under some circumstances. When unprocessed wood is cut and removed from the forest or when it enters into international trade its ultimate use is not always clear or predetermined. Indeed, because of this problem, FAO now recognizes as pulpwood removals all wood intended for manufacturing woodpulp, fibreboard or particle board.

Integrated forest industries and "full tree logging" have intensified the problem further. Long pieces of raw material initially classified as veneer logs or saw logs may supply bolts which go for pulping as pulpwood in the round. The wide and intensified use of residues from sawmilling and other wood working plants has, in many cases, brought with it a tendency away from maximising yields for the basic initial product because of the value of the by-products. The creation of machinery such as the "chip and saw" equipment with the aim of maximizing total returns is a result of these developments. As small roundwood from the forest is often chipped prior to moving to wood-pulp or wood-based panel mills, it often may not be statistically separated from chips and particles from wood residues.

Thus the actual sources of pulpwood as (a) roundwood cut for pulpwood, or (b) as part of large logs for other purposes, (c) chips from roundwood, and (d) residues from other wood processes cannot be readily identified in the usual reporting of consumption of pulpwood as (i) round or split and (ii) chips or particles.

The problem of determining the proportions of the national supply of "pulpwood" going to wood-pulp, fibreboard and particle board may not be readily resolved by the use of technical conversion because of the differing yields of different wood species of varying densities and of various processes.

Variations in factors used for converting stacked measure (e.g. cords, steres, etc.) or weight of chips into solid wood volume inside bark which results from a number of variables reflecting the nature of the raw material add to the difficulty of obtaining consistent and comparable estimates of pulpwood volume.

Time lags in the logging and pulpwood transportation process and in international trade flows and, more particularly, changes in pulpwood inventories at the various storage locations, forest, supply yards and mill yards preclude any simple and accurate substitution of removal statistics for consumption statistics or vice versa.

Hence, without a much greater and well defined statistical effort, data on national pulpwood harvests and consumption must be subject to considerable inaccuracies.

ANNEX II

PULPWOOD: ESTIMATED WORLD SUPPLY AND CONSUMPTION (1970-72) million m^3

	SUPPLY						CONSUMPTION											
		Round and split		Chips and Residues			BY TYPE			BY SECTOR								
										WOOD PULP			FIBREBOARD			PARTICLE BOARD		
	Recorded domestic removals	Net trade 1/	Supply	Net trade	domestic residues	Total Supply	Round and split	Chips and residues	Total	Round and split	Chips and resid.	Total	Round and split	Chips and resid.	Total	Round and split	Chips and resid.	Total
WORLD	311.8	- 0.9	310.9	0.8														
North America	147.0	- 1.0	146.0	- 3.8														
Canada	39.2	- 1.6	37.6	- 2.0			47.6	21.2	68.8	..	..	67.4	..	..	0.6	..	..	0.8
USA	107.8	0.6	108.4	- 1.8	49.4	156.0	..	..	144.6									
Europe	96.2	5.0	101.2	1.0			104.2	29.9	134.1	..	..	107.8	..	..	7.7	..	..	18.6
Northern Europe	56.8	1.3	58.1	0.6	11.0	69.7	55.7	14.0	69.7	53.7	11.3	65.0	0.8	2.1	2.9	1.2	0.6	1.8
Finland	19.1	1.2	20.3	0.6			19.8	5.3	25.1	19.1	4.7	23.8	0.3	0.3	0.6	0.4	0.3	0.7
Norway	4.0	2.5	6.5	0.2			6.7	1.1	7.8	6.4	0.6	7.0	0.1	0.3	0.4	0.2	0.2	0.4
Sweden	33.7	- 2.4	31.3	- 0.2			29.2	7.6	30.8	28.2	6.0	34.2	0.4	1.5	1.9	0.6	0.1	0.7
EEC	17.5	3.4	20.9	0.4			22.6	9.4	32.0	..	..	18.8	..	..	1.8	..	..	11.4
France	7.6	- 0.4	7.2	- 0.3			7.6	2.6	10.2	5.5	1.7	7.2	0.5	0.3	0.8	1.6	0.6	2.2
Germany FR	6.4	0.9	7.3	0.3			8.0	3.4	11.4	3.8	1.7	5.5	0.2	0.4	0.6	4.0	1.3	5.3
Italy	1.4	1.5	2.9	0.2			2.9	2.0	4.9	..	..	2.9	..	..	0.2	..	..	1.8
Others	2.1	1.4	3.5	0.2			4.1	1.4	5.5	..	..	3.2	..	..	0.2	..	..	2.1
Belgium	0.5	1.1	1.6	0.1			1.7	0.7	2.4	..	..	1.2	..	..	0.1	..	..	1.1
Denmark	0.1	-	0.1	-			0.3	0.3	0.6	..	..	0.3	..	..	-	..	..	0.3
Ireland	0.1	-	0.1	-			0.3	-	0.3	0.1	-	0.1	..	..	..	0.2	-	0.2
Netherlands	0.4	0.2	0.6	-			0.6	0.1	0.7	0.5	-	0.5	0.1	-	0.1	-	0.1	0.1
UK	1.0	0.1	1.1	0.1			1.2	0.3	1.5	..	..	1.1	..	..	..	..	..	0.4
Other Western Europe	3.6	1.0	9.6	-			11.1	2.1	13.2	9.2	1.2	10.4	0.1	0.4	0.5	1.8	0.5	2.3
Austria	2.1	0.9	3.0	-			3.4	1.5	4.9	2.7	1.1	3.8	-	0.2	0.2	0.7	0.2	0.9
Others	6.5	0.1	6.6	-			7.7	0.6	8.3	6.5	0.1	6.6	0.1	0.2	0.3	1.1	0.3	1.4
Greece	-	-	-	-			0.1	-	0.1	-	-	-	..	-	-	0.1	-	0.1
Portugal	2.2	- 0.1	2.1	-			2.6	-	2.6	2.4	-	2.4	..	..	..	0.2	-	0.2
Spain	2.6	-	2.6	-			3.2	0.3	3.5	2.8	-	2.8	-	0.1	0.1	0.4	0.2	0.6
Switzerland	0.9	0.2	1.1	-			1.0	0.3	1.3	0.7	0.1	0.8	-	0.1	0.1	0.3	0.1	0.4
Turkey	0.8	-	0.8	-			0.8	-	0.8	0.6	-	0.6	0.1	-	0.1	0.1	-	0.1
Eastern Europe	13.3	- 0.7	12.6	-			14.8	4.4	19.2	..	..	13.6	..	..	2.5	..	..	3.1
Bulgaria	0.4	-	0.4	-			0.7	-	0.7	0.3	-	0.3	0.1	-	0.1	0.3	-	0.3
Czechoslovakia	3.4	- 0.9	2.5	-			2.8	0.6	3.4	2.6	0.2	2.8	0.1	0.2	0.3	0.1	0.2	0.3
German DR	1.7	0.6	2.3	-			2.3	1.8	4.1	..	..	2.9	..	..	0.3	..	..	0.9
Hungary	0.6	- 0.1	0.5	-			0.5	0.1	0.6	0.3	-	0.3	0.1	-	0.1	0.1	0.1	0.2
Poland	3.2	- 0.2	3.0	-			3.1	0.5	3.6	2.3	0.1	2.4	0.5	0.3	0.8	0.3	0.1	0.4
Romania	2.5	- 0.5	2.0	-			2.6	0.9	3.5	1.9	0.4	2.3	0.3	0.3	0.6	0.4	0.2	0.6
Yugoslavia	1.5	0.4	1.9	-			2.8	0.5	3.3	2.3	0.3	2.6	0.2	0.1	0.3	0.3	0.1	0.4

1/ Negative for Net Exports, positive for Net Imports.

	SUPPLY						CONSUMPTION											
		Round and split		Chips and Residues			BY TYPE			BY SECTOR								
										WOOD PULP			FIBREBOARD			PARTICLE BOARD		
	Recorded domestic removals	Net 1/ trade	Supply	Net trade	domestic residues	Total Supply	Round and split	Chips and residues	Total	Round and split	Chips and resid.	Total	Round and split	Chips and resid.	Total	Round and split	Chips and resid.	Total
USSR	33.9	- 5.6	28.1	- 0.7					31.6			27.3			0.8			3.5
Asia	18.7	1.0	19.7	6.3														
Japan	15.0	1.0	16.0	6.3	7.1	29.4	6.2	24.9		6.1	23.2	29.3				0.1	1.7	1.8
China	2.7	-	2.7	-														
Others	1.0	-	1.0	-		-												
Bangladesh) Pakistan)	0.1	-	0.1	-														
India	0.4	-	0.4	-														
Korea Rep	0.2	-	0.2	-														
Philippines	0.2	-	0.2	-														
Oceania	3.6	-	3.6	- 0.1														
Australia	2.1	-	2.1	-														
New Zealand	1.5	-	1.5	- 0.1														
Latin America	8.5	- 0.4	8.1	-														
Argentina	1.2	-	1.2	-			0.8		0.8	0.6	-	0.6	0.1	-	0.1	0.1	-	0.1
Brazil	3.7	-	3.7	-														
Chile	-	-	-	-														
Mexico	1.2	-	1.2	-						1.2	0.3	1.5						
Others	-	- 0.4	-	-														
Africa																		
South Africa	3.0	-	3.0	-														
Swaziland	0.5	-	0.5	-														
Others	0.6	0.1	0.7	-														

1/ Negative for Net Exports, positive for Net Imports

ANNEX III

RECENT AND FUTURE ESTIMATED WOOD PULP PRODUCTION AND DERIVED 1/ PULPWOOD REQUIREMENTS

	MECHANICAL					CHEMICAL					DISSOLVING					TOTAL WOOD PULP				
	1968-70	1970-72	1975	1980	1985	1968-70	1970-72	1975	1980	1985	1968-70	1970-72	1975	1980	1985	1968-70	1970-72	1975	1980	1985
WORLD	25.2	26.8	31.7	37.9	14.7	69.6	74.8	93.3	120.8	151.1	4.5	4.8	5.6	6.6	7.8	99.3	106.4	130.6	165.3	203.6
North America	12.5	13.4	14.2	15.9	17.6	39.9	41.9	49.5	59.7	70.8	2.0	1.9	2.3	2.7	3.0	54.4	57.3	66.0	78.2	91.3
Europe	8.1	8.6	10.8	12.9	14.9	16.9	17.8	23.3	28.6	34.6	1.4	1.5	1.6	1.8	1.9	26.3	27.9	35.7	43.2	51.3
Western Europe	7.4	7.8	9.8	11.8	13.6	14.6	15.6	20.1	24.4	29.3	1.3	1.4	1.3	1.4	1.4	23.2	24.8	31.1	37.6	44.3
Eastern Europe	0.6	0.8	1.0	1.1	1.3	2.3	2.2	3.2	4.2	5.3	0.1	0.1	0.3	0.4	0.5	3.1	3.1	4.6	5.7	7.0
USSR	1.6	1.7	2.2	2.6	3.6	4.0	4.4	6.4	8.9	12.7	0.4	0.6	0.5	0.6	0.8	5.9	6.7	9.0	12.1	17.1
Asia	2.0	2.0	3.1	4.5	6.2	6.9	8.1	11.0	18.4	25.1	0.6	0.5	0.9	1.2	1.5	9.4	10.6	15.0	24.0	32.8
Japan	1.2	1.3	1.9	2.7	3.5	6.1	7.3	9.6	16.0	21.4	0.5	0.5	0.6	0.7	0.8	7.8	9.1	12.0	19.4	25.7
China	0.5	0.5	0.6	0.9	1.2	0.6	0.8	0.7	1.0	1.3	-	-	-	0.1	0.3	1.1	1.3	1.3	1.9	2.8
Others	0.4	0.2	0.7	1.0	1.5	0.2	0.1	0.8	1.4	2.4	-	-	0.3	0.4	0.5	0.6	0.3	1.7	2.8	4.4
Oceania and South Africa	0.6	0.8	0.8	1.0	1.1	0.9	1.0	1.5	2.5	3.5	0.2	0.2	0.3	0.4	0.5	1.7	2.0	2.5	3.9	5.1
Latin America	0.4	0.4	0.7	0.9	1.2	1.1	1.4	1.5	2.6	4.0	-	-	-	0.1	0.3	1.6	1.8	2.2	3.6	5.5
Africa	-	-	-	-	0.1	0.1	0.2	0.1	0.2	0.3	-	-	-	-	-	0.1	0.2	0.1	0.2	0.5
	PULPWOOD REQUIREMENTS - million m^3																			
WORLD	61.6	65.5	77.5	92.5	109.1	301.3	323.0	403.2	518.5	648.2	25.4	27.2	31.6	37.5	43.9	388.3	415.7	512.2	648.4	801.1
North America	30.7	32.8	34.6	38.9	43.1	171.0	179.8	212.5	256.0	303.5	11.2	10.9	13.1	15.1	16.8	212.9	223.6	260.2	310.0	363.4
Europe	20.1	21.4	27.0	32.2	37.1	78.2	82.4	108.2	132.9	160.9	8.0	8.8	9.2	10.0	10.6	106.4	112.6	144.3	175.1	208.7
Western Europe	18.5	19.4	24.3	29.3	33.9	66.2	70.8	91.2	111.2	133.5	7.2	8.0	7.4	7.7	7.7	91.9	98.2	122.9	148.2	175.1
Eastern Europe	1.7	2.0	2.7	2.9	3.3	12.0	11.6	16.9	21.7	27.4	0.8	0.8	1.7	2.3	2.9	14.5	14.3	21.4	26.9	33.6
USSR	4.0	4.3	5.5	6.7	9.2	19.4	21.6	31.3	43.7	62.3	2.0	3.3	2.8	3.3	4.1	25.4	29.1	39.5	53.7	75.6
Asia	4.4	4.3	6.9	10.1	13.9	23.6	27.9	38.3	63.5	87.7	3.1	3.0	5.0	6.3	8.3	31.1	35.2	50.2	79.9	109.8
Japan	2.4	2.6	3.8	5.5	7.1	19.8	23.7	31.1	52.2	69.8	3.0	3.0	3.3	3.6	4.1	25.1	29.3	38.2	61.3	81.0
China	1.1	1.3	1.5	2.1	3.0	2.9	3.8	3.5	4.7	6.5	-	-	-	0.6	1.4	4.1	5.1	5.0	7.3	10.9
Others	0.9	0.4	1.6	2.4	3.8	0.9	0.5	3.7	6.7	11.4	0.1	-	1.7	2.2	2.8	1.9	0.9	7.0	11.3	17.9
Oceania and South Africa	1.4	1.7	1.7	2.3	2.5	3.4	3.6	5.5	9.2	13.0	1.1	1.3	1.6	2.2	2.8	5.9	6.6	8.9	13.7	18.2
Latin America	1.1	1.0	1.7	2.3	3.0	5.3	6.8	7.0	12.3	19.0	-	-	-	0.6	1.4	6.4	7.8	8.7	15.1	23.4
Africa	-	-	-	0.1	0.3	0.3	0.9	0.4	0.8	1.7	-	-	-	-	-	0.4	0.9	0.5	0.9	2.0

1/ Based on national conversion factors as in TIM/ECE/WP2/R4/Add. 2, May 1973.

ANNEX IV

DERIVED PULPWOOD INPUT - ALL PRODUCTS 1970-72 1/

	Wood Pulp	Fibreboard	Particle Board	Total
	millions m3			
WORLD	415.8	19.1	32.9	467.8
North America	223.6	7.7	6.6	237.9
Canada	66.6	0.7	0.7	68.0
USA	157.0	7.0	5.9	169.9
Europe	112.6	7.8	19.9	140.4
Northern Europe	66.9	2.9	1.8	71.6
Finland	25.1	0.6	0.7	26.4
Norway	7.6	0.4	0.4	8.4
Sweden	34.2	1.9	0.7	36.8
EEC	20.4	1.9	12.2	34.5
France	7.4	0.7	1.8	9.9
Germany FR	6.7	0.6	6.4	13.7
Italy	2.9	0.2	1.8	4.9
Others	3.4	0.4	2.2	6.0
Belgium	1.4	0.1	1.1	2.6
Denmark	0.3	-	0.4	0.7
Ireland	0.1	0.1	0.2	0.4
Netherlands	0.5	0.1	0.1	0.7
UK	1.1	0.1	0.4	1.6
Other Western Europe	9.9	0.5	2.5	12.9
Austria	3.9	0.2	1.1	5.2
Others	6.0	0.3	1.4	7.7
Portugal	2.1	-	0.2	2.3
Spain	2.4	0.1	0.6	3.1
Switzerland	0.8	0.1	0.5	1.4
Turkey	0.7	0.1	0.1	0.9
Eastern Europe	15.5	2.5	3.4	21.4
Bulgaria	0.4	0.1	0.3	0.8
Czechoslovakia	3.6	0.3	0.4	4.3
German DR	3.7	0.3	1.0	4.6
Hungary	0.2	0.2	0.2	0.6
Poland	3.1	0.8	0.4	4.3
Romania	2.6	0.6	0.7	3.9
Yugoslavia	2.3	0.2	0.4	2.9
USSR	29.1	..	3.4	32.5
Asia	35.2	2.2	1.3	38.7
Japan	29.2	1.2	0.8	31.2
China	5.0	0.5	0.1	5.6
Others	1.0	0.5	0.4	1.9
Bangladesh - Pakistan	0.1	-	-	0.1
India	0.4	0.1	-	0.5
Korea Rep	0.2	-	0.1	0.3
Korea PDR	-	-	-	0.1
Philippines	0.2	0.1	-	0.3
Others	-	0.3	0.3	0.6
Oceania	3.6	0.5	0.5	4.6
Australia	1.5	0.4	0.4	2.3
New Zealand	2.1	0.1	0.1	2.3

ANNEX IV (continued)

Latin America	7.8	0.7	1.0	9.5
Argentina	0.8	0.1	0.2	1.1
Brazil	3.9	0.3	0.5	4.7
Chile	1.4	0.1	-	1.5
Mexico	1.5	0.1	0.1	1.7
Others (Colombia)	0.2	0.1	0.2	0.5
Africa	4.0	0.2	0.2	4.4
South Africa	3.1	0.2	0.1	3.4
Swaziland	0.5	-	-	0.5
Others	0.4	-	0.1	0.5

1/ Based on national factors.

ANNEX V

CONIFEROUS GROWING STOCK, GROWTH AND 1972 REMOVALS

	GROWING STOCK			1/ Gross Growth	REMOVALS 1972				
	In forest	% of total	Outside forest		Total	Fuelwood	Fuelwood % of total	Total as Percent of growing stock	Total as Percent of gross growth
	million m^3		million m^3					million m^3	
WORLD	..	..	..	..	1108.6	173 1	16		..
North America	26627	74		608.6	381.3	3.8	1	1.6	70
Canada	14242	80		225.5	109.0	1.3	1	0.9	54
USA	12385	68		383.1	272.3	2.5	1	2.4	79
Europe	8728	65	245	281.5	214.0	17 9	8	2.7	84
Northern Europe	3423	83	96	121.1	90.2	2.8	3	2.9	83
Finland	1168	81	38	43.6	31.3	1.4	4	3.0	80
Norway	425	83		12.4	7.4	0.2	3	1.9	66
Sweden	1830	85	58	65.1	51.5	1.2	2	3.1	88
EEC	1487	56	52	57.1	39.2	2.2	6	2.9	76
Belgium	31	54		1.6	2.1	0.3	14	7.5	150
Denmark	17	47		1.4	1.2	-	-	8.0	92
France	450	46	2	15.0	14.7	1.0	7	3.6	109
Germany	722	71		28.7	16.8	0.4	2	2.6	65
Ireland	11	100		0.6	0.4	-	-	4.0	80
Italy	168	45	46	3.2	1.3	0.2	15	0.9	45
Luxembourg	2	17		0.1	0.1	-	-	5.0	100
Netherlands	16	80		1.0	1.0	-	-	7.1	111
UK	70	57	4	5.5	1.6	0.2	13	2.5	32
Other Western Europe	1632	73	71	47.1	37.5	9.3	25	2.6	88
Austria	562	85		14.2	10.4	0.3	3	2.1	81
Cyprus	3	100		0 1	0.1	-	-	3.3	100
Greece	73	48		2.5	0.6	0.3	50	0.9	26
Portugal	90	52		6.9	5.1	0.4	8	6.3	82
Spain	248	69	5	10.9	7.6	1.9	25	3.4	78
Switzerland	180	75	1	3.3	2.9	0.2	7	1.8	97
Turkey	476	72	65	9.2	10.8	6.3	58	2.5	130
Eastern Europe	2186	50	26	56.2	47.0	3.6	8	2.4	93
Albania	..	..		..	0.8	0.4	50	..	..
Bulgaria	76	34		1.6	1.5	0.1	7	2.2	107
Czechoslovakia	495	74		11.5	11.0	0.7	6	2.5	106
German DR	257	73		9.2	6.5	0.7	11	2.8	78
Hungary	11	7		0.5	0.3	-	-	3.0	75
Poland	669	81		18.8	15.4	1.1	7	2.6	91
Romania	427	37		8.8	7.1	0.5	7	1.8	90
Yugoslavia	251	27	8	5.8	4.5	-	-	1.8	85
USSR	61240	84		577	319.0	55.5	17	0.6	61
Asia and Pacific	..	..		..	137.8	68.4	50	..	..
Japan	960	52		41.5	25.4	-	-	2.9	68
China	..	..		..	80.6	53.0	66	..	..
Korea	38	62		0.3	6.6	5.0	76	19.4	2200
Australia	79	8		5.7	2.6	-	-	3.7	51
New Zealand	258	95		8.6	8.5	0.5	6	3.7	110
Others	..	..		..	14.1	9.9	70	..	..
Latin America	..	..		..	45.4	22.6	50	..	..
Argentina	..	..		..	0.8	-	-	..	..
Brazil	239	-		2.5	26.1	15.0	57	12.1	1135
Chile	140	11		6.0	4.3	0.3	7	3.4	80
Mexico	540	100		10.5	7.5	2.7	36	1.5	80
Others	..	..		..	6.7	4.6	69	..	..
Africa	..	..		..	11.2	4.9	44	..	..
South Africa	55	50		6.8	4.0	0.1	2	8.0	66
Swaziland	..	..		..	1.3	-	-	..	..
Others	..	..		..	5.9	4.8	81	..	..

1/ Growth figures for Canada, the USSR, Japan and German DR are net growth.

ANNEX VI

NON-CONIFEROUS GROWING STOCK, GROWTH AND 1972 REMOVALS

	GROWING STOCK			1/ Gross Growth	REMOVALS 1972				
	In forest	% of total	Outside forest		Total	Fuelwood	Fuelwood % of total	Total as Percent of growing stock	Total as Percent of gross growth
	million m^3		million m^3					million m^3	
WORLD	..	..		..	1353.9	976.2	72	..	..
North America	9459	26		342.4	94.1	13.4	14	1.1	31
Canada	3583	20		78.4	10.7	2.5	23	0.3	15
USA	5876	32		264.0	83.4	10.9	13	1.6	35
Europe	4543	34	585	153.8	125.6	52.9	42	3.1	91
Northern Europe	690	17	18	27.4	19.0	8.4	44	3.1	77
Finland	273	19	11	11.7	11.6	5.9	51	4.7	110
Norway	89	17		3.2	0.9	0.5	56	1.1	31
Sweden	328	15	7	12.5	6.5	1.9	29	2.2	58
EEC	1145	44	310	50.5	41.4	13.2	32	4.0	91
Belgium	26	46	1	1.1	0.9	0.1	11	3.9	90
Denmark	19	53		0.8	0.9	0.1	11	5.3	128
France	530	54	30	28.0	19.2	4.8	25	4.0	76
Germany	300	29		9.0	6.9	1.4	20	2.6	85
Ireland	-	-		0.1	-	-	-	-	-
Italy	203	55	247	9.7	11.8	6.7	57	6.4	136
Luxembourg	10	33		0.1	0.1	-	-	1.1	100
Netherlands	4	20	2	0.2	0.6	-	-	20	300
UK	53	43	30	1.5	0.9	0.1	11	1.9	69
Other Western Europe	613	27	131	21.7	23.3	15.9	68	4.2	121
Austria	98	15		2.5	2.1	0.8	38	2.4	95
Cyprus	-	-	-	-	-	-	-	-	-
Greece	79	52		2.5	2.3	2.0	87	3.2	104
Portugal	84	48	1	2.0	1.9	0.3	16	2.5	106
Spain	109	30	10	6.5	8.4	5.9	70	8.5	105
Switzerland	60	25	1	1.2	1.1	0.6	54	2.0	122
Turkey	183	28	119	7.0	7.5	6.4	85	4.3	119
Eastern Europe	2095	48	126	54.2	41.9	15.4	37	2.2	86
Albania	..	-			1.5	1.2	80	..	..
Bulgaria	150	66		4.5	3.4	1.0	29	2.5	83
Czechoslovakia	174	26		2.9	3.7	0.9	24	2.4	142
German DR	93	26		2.0	1.4	-	-	1.7	78
Hungary	141	93		6.6	5.1	2.6	51	4.0	86
Poland	160	19		3.8	3.3	1.0	30	2.3	97
Romania	715	63	11	17.5	14.1	4.9	35	2.2	90
Yugoslavia	662	73	115	16.9	9.2	3.8	41	1.5	60
USSR	12010	16		267	64.0	29.9	47	0.6	27
Asia & Pacific	..	..		..	538.6	413.5	77	..	..
Japan	890	48		35.0	20.8	1.7	8	2.6	66
China	..	..		..	98.4	81.1	82	..	..
Korea	29	48		1.0	2.9	2.5	86	11.2	322
Australia	974	92		16.3	11.5	2.2	19	1.3	78
New Zealand	14	5		..	0.3	0.1	33	2.3	..
Others	..	..		..	404.8	325.9	80	..	..
Latin America	..	..		..	238.7	208.3	87	..	..
Argentina	..	..		..	11.9	8.8	74	..	..
Brazil	80555	100		368.7	137.7	125.0	91	0.2	42
Chile	1100	89		11.7	4.1	2.7	66	0.4	39
Mexico	..	..		..	6.7	6.3	94	..	..
Others	..	..		..	78.3	65.5	84	..	..
Africa	..	..		..	292.9	258.3	88	..	..
South Africa	53	50		7.1	5.6	0.8	14	11.2	88
Swaziland	..	..		..	0.5	0.4	80	..	..
Others	..	..		..	286.7	257.0	90	..	..

1/ Growth figures for Canada, the USSR and Japan are net growth.

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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FAO ADVISORY COMMITTEE ON PULP AND PAPER

Fourteenth Session - Rome, 17 and 18 May 1973

WASTE PAPER DATA 1970-1972

by

the Secretariat

1. Introduction

In order to compare the pattern of changes in waste paper use for paper and paperboard production from the last FAO enquiry in 1969, the Secretariat circulated at the beginning of 1973 a questionnaire to the Advisory Committee members, and to industry associations, or similar, in eight additional countries with paper industry of considerable size. Also, the questionnaire was designed to test the various countries acceptance of the vocabulary of different waste paper definitions presently used by FAO.

This vocabulary with explanations, and the questionnaire are attached as Appendix I. The detailed answers as requested were received from 21 countries[1/] (of a total of 29 contacted). These are presented as such in Appendix II and summarized in Table No. 1. The situation in 1964, 1966, 1968 and 1970-72 is summarized in Table No. 2 for those 13 countries from where the corresponding data are available.

2. Changes in Recovery and Consumption of Waste Paper

As seen from Appendix II, there have been some changes in the recovery and consumption rates of a few countries from 1964 to 1972. The biggest recovery rate increases are recorded in Belgium, Italy, Mexico and the Netherlands; the few decreases amount only to less than one per cent each. The upward trend in the consumption rate is very clear in Austria, France, the Federal Republic of Germany, Italy, Mexico and the Netherlands, but declining rates are registered in Belgium and Japan. Over the three-year period of 1970-72 there are also a few very marked, mostly upward movements in the rates, may be as a result of both environmental considerations and of movements in the marketing situation of market pulp.

1/ A total of 26 replies were received, but in five of them the information is incomplete. Three countries did not reply.

Table No. 1

Summary of Waste Paper Collection and Recovery and Consumption Rates in 1970, 1971 and 1972 in Selected Countries 1/
(1,000 metric tons)

	Consumption of paper and paperboard	Collection of waste paper	Recovery rate Per cent	Exports of waste paper	Imports of waste paper	Waste paper used for paper and paperboard	Total fibre used for paper and paperboard	Consumption rate Per cent	Paper and paperboard production
1970	100,268	26,684	26.6	1,476	1,483	25,717	111,018	23.2	105,996
1971	101,389	26,924	26.6	1,385	1,327	26,253	110,273	23.8	106,375
1972	107,911	28,886	26.8	1,546	1,639	28,294	117,275	24.1	112,948

1/ Countries included: see Appendix II.

Table No. 2

Changes in Waste Paper Recovery and Consumption Rates in Selected Countries 1/ from 1964 to 1972

	1964	1966	1968	1970	1971	1972
Recovery rate	25.5	24.2	24.5	26.8	26.7	26.8
Consumption rate	26.6	25.9	25.8	26.2	26.6	27.0

1/ Countries included: Austria, Belgium, Finland, France, Germany F.R., Italy, Japan, Mexico, Netherlands, Norway, Switzerland, U.K., U.S.A. These correspond to 73 per cent of the world's paper consumption and 57 per cent of the world's production.

However, if a group of countries is taken under scrutiny, the percentual rate changes are insignificant as seen in Tables Nos. 1 and 2, although the trend to increased recovery and consumption is unmistakable. The tonnage growths are certainly very much clearer and bigger because of the increased paper and paperboard consumption and of increased percentage rates.

3. Waste Paper Vocabulary

The answers received to the Secretariat's questionnaire did not raise any objections or doubts about the terms and definitions used therein. It is therefore to be assumed that the members of the Advisory Committee fully accept the vocabulary, of which the two most important and often wrongly interpreted definitions are:

"Waste Paper Recovery Rate" defined as "the amount of waste paper collected as a percentage of total paper and paperboard consumed in a particular country or region"; and

"Waste Paper Consumption Rate" defined as "the amount in percentage of waste paper used in each country or region by its paper and paperboard mills relative to the total amount of papermaking fibres used by these mills."

These terms and definitions are also accepted and recommended by a recent authoritative study on the utilization of waste paper 1/ which places special emphasis on the need to adopt worldwide, irrefutable names and definitions to these basic concepts;

The Secretariat therefore suggests that in the future only these terms be used in this connection and that, whenever possible, their general acceptance be promoted.

1/ "Waste Paper Recycling" - Joseph E. Atchison Consultants, Inc., New York, Dec. 1972.

APPENDIX I

EXPLANATORY NOTES

By consumption of paper and paperboard it is meant the total quantity of paper and paperboard (also when combined with other materials) consumed within the country.

Collection of waste paper means the total quantity of waste paper collected from the paper using industries (mainly packaging and printing industries), offices, archives and libraries, stores and shops and from households, in any form and for any kind of uses (including also other uses than paper and paperboard manufacturing).

Exports and imports of waste paper are the quantities of all kinds of waste paper exported and imported for any kind of use.

Waste paper used for paper and paperboard. This is the quantity of any kind of waste paper either locally collected or imported which is used to make paper and paperboard.

Total fibre used for paper and paperboard is the total quantity of input of fibres for paper and paperboard manufacturing. The fibres can be of wood (round, split, chips, residues, sawdust, etc.), of non-wood fibrous vegetable materials (bagasse, straw, bamboo, reeds, esparto, rags, etc.), and waste paper.

Paper and paperboard production is the quantity of paper and paperboard (fibre building boards not included) of any kind produced within the country.

FAO QUESTIONNAIRE ON WASTE PAPER

COUNTRY:

	1970	1971	1972
	1,000 metric tons		
Consumption of paper and paperboard			
Collection of waste paper			
Exports of waste paper			
Imports of waste paper			
Waste paper used for paper and paperboard			
Total fibre used for paper and paperboard			
Paper and paperboard production			

COLLECTION AND RECOVERY AND CONSUMPTION RATES OF WASTE PAPER IN SELECTED COUNTRIES IN 1964, 1966, 1967 AND 1970, 1971, 1972

Years: 1964 to 1972

	Recovery rates (%)						Consumption rates (%)					
	1964	1966	1968	1970	1971	1972	1964	1966	1968	1970	1971	1972
Japan	39.2	39.8	36.6	40.0	37.6	39.5	38.1	36.8	34.8	34.0	33.5	35.2
New Zealand	11.8	11.3	14.0	11.3	11.1	N.A.	7.4	8.3	8.9	6.7	6.9	N.A.
Austria	24.5	25.9	N.A.	19.7	22.9	24.3	19.1	19.9	22.3	20.4	20.9	22.2
Belgium	26.3	27.8	N.A.	30.4	26.5	30.9	26.1	24.0	N.A.	23.0	19.2	18.9
Finland	19.0	24.6	19.3	25.5	22.1	18.8	3.0	4.1	3.3	3.4	3.4	2.9
France	28.6	26.6	27.2	27.5	27.7	28.3	29.3	32.3	32.4	33.9	35.4	36.0
Germany, Fed. Rep.	26.6	27.2	28.6	31.5	30.7	29.6	43.8	44.6	46.0	46.3	46.7	46.6
Italy	14.8	19.7	20.6	20.5	21.4	22.2	23.4	28.2	27.2	27.5	31.8	33.2
Netherlands	35.3	35.0	40.6	42.1	41.6	43.9	24.1	24.5	32.6	35.6	39.7	39.1
Norway	19.4	16.7	16.9	18.3	18.0	18.6	6.3	6.8	6.2	7.3	7.2	7.2
Switzerland	33.6	35.0	N.A.	30.9	34.5	35.2	N.A.	N.A.	N.A.	30.6	35.0	34.6
United Kingdom	26.8	27.1	N.A.	27.7	27.7	26.2	33.0	34.4	36.8 1/	33.9	36.7	37.4
Mexico	36.2	34.1	N.A.	29.8	40.0	43.2	44.2	42.6	44.4	39.4	45.3	48.2

1/ Estimates.

Year: 1970 (1,000 tons)

	Consumption of paper and paperboard	Collection of waste paper	Recovery rate Per cent	Exports of waste paper	Imports of waste paper	Waste paper used for paper and paperboard	Total fibre used for paper and paperboard	Consumption rate Per cent	Paper and paperboard production
Australia	1,498	388 1/	25.9	12	9	364 1/	1,144 1/	31.8	1,053
Japan	12,260	4,900 1/	40.0	6	110	4,696	13,801	34.0	12,973
New Zealand	355	40	11.3	2	-	33	491	6.7	455
Austria	580	114	19.7	14	100	200	979	20.4	1,017
Belgium	1,044	317	30.4	162	23	178	775	23.0	772
Egypt, Arab Rep.	208	90	43.3	-	2	92	150	61.3	135
Finland	549	140	25.5	-	33	146	4,240	3.4	4,258
France	4,797	1,318	27.5	87	137	1,425	4,200	33.9	4,134
Germany, Fed.Rep.	7,628	2,403	31.5	184	320	2,511	5,422	46.3	5,504
Italy	3,554	729	20.5	1	284	1,012	3,681	27.5	3,460
Netherlands	1,796	756	42.1	225	76	576	1,617	35.6	1,589
Norway	460	84	18.3	9	27	102	1,400	7.3	1,422
Spain	1,448	454	31.3	2	55	394	1,385	28.4	1,280
Sweden	1,510	350	23.2	91	20	225	4,520	5.0	4,358
Switzerland	962	297	30.9	123	36	210	687	30.6	731
Tunisia	34	3	7.4	-	-	3	7	35.7	8
United Kingdom	7,179	1,986	27.7	100	27	1,947	5,740	33.9	4,903
Canada	3,230	630	19.5	90	75	535	11,885	4.5	11,135
United States	49,995	11,303 1/	22.6	370	61	10,592	48,122	22.0	46,117
Mexico	1,159	345	29.8	-	43	388	986	39.4	897
Venezuela	377	77	20.4	-	45	121	277 1/	43.7	250

1/ Estimates.

Year: 1971 (1,000 tons)

	Consumption of paper and paperboard	Collection of waste paper	Recovery rate Per cent	Exports of waste paper	Imports of waste paper	Waste paper used for paper and paperboard	Total fibre used for paer and paperboard	Consumption rate Per cent	Paper and paperboard production
Australia	1,570	406 1/	25.9	13	10	381 1/	1,165 1/	32.7	1,072
Japan	12,459	4,680 1/	37.6	9	84	4,602	13,751	33.5	12,907
New Zealand	343	38	11.1	2 1/	-	34	496	6.9	459
Austria	624	143	22.9	15	85	213	1,018	20.9	1,073
Belgium	1,095	290	26.5	166	15	145	755	19.2	770
Egypt, Arab Rep.	221	91	41.2	-	5	96	155	61.9	141
Finland	610	135	22.1	-	5	148	4,370	3.4	4,424
France	4,961	1,372	27.7	75	134	1,512	4,271	35.4	4,226
Germany, Fed.Rep.	7,659	2,351	30.7	116	296	2,549	5,454	46.7	5,582
Italy	3,412	731	21.4	2	258	987	3,104	31.8	3,288
Netherlands	1,734	721	41.6	185	76	622	1,568	39.7	1,521
Norway	456	82	18.0	7	22	97	1,340	7.2	1,359
Spain	1,631	570	34.9	5	39	547	1,558	35.1	1,506
Sweden	1,510	350	23.2	78	19	265	4,420	6.0	4,238
Switzerland	918	317	34.5	127	25	215	615	35.0	700
Tunisia	36	3	8.3	-	-	3	14	21.4	15
United Kingdom	6,754	1,872	27.7	77	9	1,835	4,997	36.7	4,336
Canada	3,285	690	21.0	130	125	610	11,565	5.3	10,945
United States	50,976	11,595 1/	22.7 1/	380	62	10,843	48,871	22.2	47,109
Mexico	1,101	440	40.0	-	13	453	999	45.3	908
Venezuela	377	85	22.5	-	45	130	283 1/	45.9	255

1/ Estimates.

Year: 1972 (1,000 tons)

	Consumption of paper and paperboard	Collection of waste paper	Recovery rate Per cent	Exports of waste paper	Imports of waste paper	Waste paper used for paper and paperboard	Total fibre used for paper and paperboard	Consumption rate Per cent	Paper and paperboard production
Australia	1,519	425 1/	28.0	9	13	401 1/	1,188 1/	33.8	1,093
Japan	13,340 1/	5,265 1/	39.5 1/	10 1/	95 1/	5,180 1/	14,705 1/	35.2 1/	13,647
New Zealand	N.A.	34	N.A.	2 1/	-	37	N.A.	N.A.	N.A.
Austria	650 1/	158 1/	24.3 1/	19 1/	110 1/	249 1/	1,120 1/	22.2 1/	1,180 1/
Belgium	1,129	349	30.9	213	10	149	789	18.9	783
Egypt, Arab Rep.	225	94	41.8	-	6	100	160	62.5	144
Finland	690	130	18.8	-	-	140	4,860	2.9	4,965
France	5,391	1,523	28.3	113	171	1,640	4,552	36.0	4,529
Germany, Fed.Rep.	8,012	2,374	29.6	147	389	2,610	5,606	46.6	5,855
Italy	3,620	802	22.2	N.A.	379	1,181	3,555	33.2	3,452
Netherlands	1,786 2/	784 2/	43.9 2/	220 2/	46 2/	610 2/	1,559 2/	39.1 2/	1,560 2/
Norway	446	83	18.6	10	22	95	1,323	7.2	1,348
Spain	1,617 2/	580	35.9 2/	6	42	554 2/	1,655	33.4 2/	1,511 2/
Sweden	1,570	400	25.5	90	20	285	4,830	5.9	4,562
Switzerland	917	323	35.2	129	31	225	651	34.6	700
Tunisia	38	4	9.2	-	-	4	18	20.0	18
United Kingdom	7,145	1,869	26.2	74	11	1,881	5,027	37.4	4,338
Canada	3,550 1/	720 1/	20.3 1/	130	160	670 1/	12,235 1/	5.5 1/	11,580 1/
United States	54,682	12,390 1/	22.7 1/	376	80	11,654	52,059	22.4	50,428
Mexico	1,189 1/	514	43.2 1/	-	6	520	1,079	48.2	981
Venezuela	395	99	25.1	-	47	146	304 1/	48.0	274

1/ Estimates

2/ Provisional

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A PERSPECTIVE ON THE ENVIRONMENTAL PROTECTION SITUATION IN THE PULP AND PAPER INDUSTRY

Introductory Report
prepared for UNEP
by
John E.G. Sikes, Canada

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A PERSPECTIVE ON THE ENVIRONMENTAL PROTECTION SITUATION IN THE PULP AND PAPER INDUSTRY

TABLE OF CONTENTS

SUMMARY

The pulp and paper industry has often been considered, with some justification, as being a gross polluter. In recent years, as the environmental issue became widely recognised, the industry has been the subject of scrutiny by legislators. As a result, it has embarked on concerted pollution abatement programs and the total quantity of discharges and emissions is projected to be sharply reduced in the future.

Environmental regulations specific to the industry are structured on widely different principles, from individual assessment based on the assimilative capacity of the receiving environment, to blanker, uniform requirements, to taxes based on the amount of pollutants discharged. In the developing countries, the trend is to undertake some form of environmental impact assessment and to plan control measures specific to each case.

The costs of pollution control are becoming increasingly significant to the pulp and paper industry, and some segments of the industry appear more vulnerable than others to absorb additional costs. Substantial investment capital, estimated at about U.S. dollars 10,000 million during the 1970's, will be required to apply environmental control measures. Considerable difficulty in raising this capital is anticipated.

Insofar as many of the problems facing the industry are common between nations, and since the approached to solving these problems appear to vary, it is questioned whether there is presently sufficient international dialogue on this subject.

INDUSTRY STRUCTURE

Although paper was made by hand more than a thousand years ago in the Orient and seven hundred years ago in Europe, the pulp and paper industry, in its present form, is only about one hundred years old. It is still in a period of rapid evolution. A modern mill is superior to one constructed twenty years ago because of improved technology and better machinery. Developments in environmental control methodology show even greater improvement.

In order to assess the environmental situation of the international pulp and paper industry, it is necessary to stress several factors :

- Environmental conditions and the structure of the industry vary widely between countries.
- National environmental policies are dissimilar between countries, both in philosophical approach and methods of implementation.
- There is no international agreement on monitoring techniques resulting in a disorganized data base.
- Few countries have developed means of obtaining pollution control information from the industry on a national basis and there is presently no mechanism whereby these data can be compared internationally.
- There is no formal mechanism for international exchange of knowledge concerning pollution control technology in the industry.
- The pulp and paper industry is highly competitive and its profitability has been historically cyclical. These aspects are important when assessing the ability of the industry to undertake long-term environmental planning in a rapidly changing technological, legislative and social system.

The above factors compound the difficulty of making an objective analysis of an already highly emotional subject. Despite this, since environmental factors are becoming increasingly important

to the industry, it is necessary to understand the viewpoints of all parties concerned, be they the public, legislators or industry, to develop a cohesive approach to the problem and to mitigate potential conflicts that may arise at a later date.

NATURE OF POLLUTANTS

The pulp and paper industry often is considered, with some justification, as being a gross polluter. One old sulphite mill, for example, may discharge organic matter in its effluents equivalent to that emanating from a city of two million people; the odour of an inefficient sulphate mill may be detectable at a distance of 50 kilometres; a stream receiving wastes from a paper mill may be coloured due to additives and dyes used in the process; certain chemicals in an effluent used as irrigation water may have ruined land for agricultural use. Specific examples of pollution by the industry are numerous.

The following summarizes the nature of potential pollutants from the pulp and paper industry:

Water Pollution

Pulp and paper mill effluents may contain: suspended solids such as bark particles, fibres and dirt; dissolved organic material including hemicellulose, sugars, turpentines, sizing agents and adhesives; colour bodies, mainly lignins and dyes; dissolved inorganics such as spent pulping and bleaching chemicals, nutrients, trace metals and slimicides; and thermal loads. Generally, effluents from the industry are not thought of as being seriously persistant.

Legislation is largely directed towards the control of pH, suspended solids and Biochemical Oxygen Demand (BOD), although some countries use Chemical Oxygen Demand (COD) in place of BOD. Control of these parameters to acceptable levels usually also minimizes the effect of other parameters.

The magnitude of the water pollution problem is greatest in the chemical pulp industry, more specifically with older sulphite mills, and those mills processing agricultural residues where substantial purging of impurities, present in the raw materials, is required. It also tends to be more serious in older, inefficient mills where major modifications are disproportionately expensive. Paper mills, although discharging smaller quantities of pollutants, in some cases may have equally serious problems due to their tendency to be located away from larger watercourses.

Air Pollution

Most air pollution problems of the pulp industry are related to sulphur compounds, present in practically all chemical pulp manufacturing. Particulate emissions are normally restricted to the immediate neighbourhood of pulp mills.

Sulphur dioxide is certainly the most serious air pollutant. It can threaten health and the local regional or even international environment when combined with other industrial emissions. The sulphite industry is responsible for the greatest emission of sulphur dioxide.

Odourous gases, such as hydrogen sulphide and organo-sulphur compounds are normally present in quantities below the threshold limit values, but generally well above levels that can be detected by the human nose. The smell can be extremely objectionable. While the odour problem is greatest with sulphate mills, it should be noted that modern technology, if applied, is such that under normal operation, the odour from a modern sulphate mill is detectable only under adverse meteorological conditions.

Paper mills do not have significant air pollution problems, although,as with pulp mills, water vapours emitted can be either aesthetically objectionable, or contribute to local fogging during certain climatic conditions.

Solid Wastes

Solid wastes from the pulp and paper industry generally have received little attention from either the industry or the legislators. The principal solids wastes from the industry may be listed as bark, fibre, lime sludge, ash and sludge from wastewater treatment plants. As traditional landfill sites are becoming more scarce, with greater restrictions placed on their operation, solid waste disposal is likely to become a mounting burden to the industry. There is an increasing tendency, where possible, to undertake more complete utilization of industrial residues.

Noise

The noise pollution problem of the industry is generally restricted to specific areas within the plant. Noise and related aspects of working conditions, are receiving ever-increasing attention by labour and industry management.

ENVIRONMENTAL LAWS AND REGULATIONS

All major pulp producing countries have basic legislation covering water pollution control in the pulp and paper industry. Air pollution control legislation usually is not as advanced and often still badly defined. Legislation concerning solid wastes is virtually non-existent, except in some local instances.

In the developing countries which have some form of environmental legislation, this is generally based on water pollution control, usually derived from requirements for domestic effluents in other countries, and certainly not specific to the forest products industry.

Water Pollution Control

The philosophical approaches used by various countries in developing environmental legislation for the industry vary widely, ranging from use of the assimilative capacity of the

receiving environment to application of best practicable control technology. These approaches are translated into legislation through the following types of system:

- Discharge fee: this is a tax, based on the quantity of specific pollutants in the effluents, sometimes on an increasing scale with respect to time. The revenue collected is usually used for the construction of treatment plants. This approach is used in several European countries.
- Case-by-case analysis: the discharge of effluent is assessed on an individual basis, based on the assimilative capacity of the receiving waters. In some countries, this system is simplified by classifying waters into various categories, and relating allowable discharges to these categories.
- Uniform standards: all discharges must comply with uniform minimum standards, applied nationally or regionally. In some instances local environmental circumstances may override these standards and require more stringent effluent criteria.

In most countries, the trend is for new mills to be required to conform to the regulations from start-up, and existing mills either by a specified date, or by a phased program of improvements on a schedule negotiated with the regulatory agency.

Air Pollution Control

While air pollution control legislation in major pulp and paper producing countries is not as advanced as that relating to water pollution control, it is generally based on the same, widely varying principles, ranging from limits set on ambient air quality to limits set on specified emissions and from the application of best practicable technology to maintenance of acceptable ambient air quality. Requirements, moreover, in some instances, are negotiated on an individual basis; in others they are national.

In several countries where emphasis is being given to curtailment of sulphur dioxide emissions,restrictions are placed on the sulphur content of fuel oil.

Approach Used in Developing Countries

In the developing countries, as well as in those countries without legislation specific to the pulp and paper industry, the environmental issue is generally recognized. When new production is being planned, and particularly when international agencies are involved in the planning process, some form of environmental impact assessment is usually required. This forms the basis of determining not only acceptable process and treatment criteria, but also the overall environmental implications of the project.

General Assessment of Legislative Approaches

It has been noted that the approach to environmental legislation varies widely between nations. Insofar as there is a fundamental need for protection of the environment, although this need is greater in some parts of the world than in others, the question must be raised as to whether the differing approaches can be harmonized.

The pulp and paper industry manufactures products that are internationally competitive, and the cost of pollution control is becoming increasingly significant. Thus, there is a risk that differing national environmental policies may be translated into potential conflicts in trading patterns.

A severe problem facing forest products companies in some countries is the requirement to comply with orders from several levels of government, perhaps national, regional and local. In many instances, these different bodies have varying requirements, resulting in confusion on the part of industry. There appears to be a need in some countries to harmonize the approaches of various levels of government.

Another complicating factor for the industry is the ever-changing nature of environmental legislation. With few exceptions, this has only really evolved during the last decade, and in virtually all countries is still fluid. If individual mills are to make major commitments to adjust their manufacturing process or to install apprppriate control equipment, the threat of imminent changes in the rules can only compound the problem facing the industry.

POLLUTION CONTROL TECHNIQUES

During the last decade or so, as the gravity of the environmental issue became recognized, tremendous advances have been made in understanding the problem and developing means to combat it. Certainly much still needs to be done, from the educational standpoint, and from the legislative and technical approaches.

In the past,industry probably felt relatively little compulsion to cope with, or even acknowledge, the environmental ramifications of its manufacturing process, and profitability was paramount. Recently, the industry has been making rapid progress towards combating pollution, either through legislative pressure, social compulsion, or the basic need to become more efficient.

Internal Techniques

In undertaking pollution control programs, the logical area of initial endeavour is within the production process. It has been estimated, for example, that in the average mill one-third of losses to the sewer are as a result of leaks and spills. In many mills this proportion is certainly greater. As water, fibre, energy and chemicals become increasingly valuable, special attention is being given to increasing the efficiency of the production process, and the recovery rate of materials and chemicals.

Many of the steps being undertaken by existing mills relate to modifying the process. Examples include conversion of wet

debarking to dry debarking, better washing of pulp and improved recovery of cooking chemicals, more complete utilization of rejected fibre,modification of bleaching sequences and more countercurrent washing in bleach plants, improved evaporator and recovery operations, stripping of condensates for re-use, closing-up paper machine white water systems, upgrading precipitators and scrubbers, installing spill control facilities, improved monitoring and instrumentation and,perhaps above all, educational programs to enhance operator motivation.

The list is lengthy. In the last decade the water use of a newly constructed pulp and paper mill has been reduced by a factor of two or more. Similar reductions are possible for total losses of chemicals and fibre. Atmospheric emissions of mills constructed today are a fraction of those of a decade ago.

For existing mills it is frequently difficult to undertake extensive process modifications in one step due to the interdependence of the many production components. A gradual program is normally implemented.

External Techniques

It is probable that no pulp or paper mill is being constructed today, or even considered, where environmental factors are not taken into account. A decade ago, such factors, would have been considered only superficially.

The methods used for external treatment of effluents from the industry are generally derived from municipal effluent treatment techniques: sedimentation, sometimes with chemical addition to enhance performance, various means of biological treatment and efficient dilution in the receiving waters. Where irrigation is practised, increasing attention is being given to the acceptability of effluents for use as irrigants. In some countries, particular attention is being given to the eutrophication issue, and also the colour of effluents, especially from bleached sulphate mills. To date, methods for removal of colour and nutrients generally involve chemical coagulation and precipitation.

Air pollution control equipment being used includes high efficiency precipitators, scrubbers, fabric filters, inertial separators and incinerators.

Present Status of Pollution Control Technology

The pulp and paper industry now is undergoing a stage of rapid change in its implementation of pollution control measures.

New mills, certainly in industrialized nations, are required to achieve rigorous effluent and emission criteria, usually through the use of proven, modern technology. The modern regulatory criteria are such that not only must appropriate treatment systems be installed, but the basic process must maximize water re-use and recovery of chemicals and fibre. Enormous strides have been taken in the last few years to achieve the ultimate goal of a pulp or paper mill having no effluent discharge.

New mills in developing countries usually are subject to some form of environmental impact assessment, with process, treatment and disposal schemes specific to their own needs. While perhaps not as advanced as in industrialized nations, the approach is nevertheless similar. Developing nations may decide that it is better to forgo technical innovations which entail some risk, in favour of reliability and dependability.

For existing mills in all countries, but more especially in industrialized nations, where legislative machinery reacts quicker to the public's demands, and where the major technical expertise exists, the situation is changing rapidly.

With few exceptions, all mills have in the last several years, undertaken programs to economize on water use and to control obvious sources of loss of fibre and chemicals. These are normally evaluated and undertaken by mill personnel and generally represent an economic benefit.

A further step which is underway in many mills is one which may involve the use of additional expertise. This step involves the use of advanced proven technology such as improving the washing

efficiency, closing up screening systems, reducing bleach plant water use, stripping condensates,and installing equipment to reduce atmospheric emissions and external treatment plants. Some mills have completed this stage, some are presently in it, and others are studying its feasibility.

The most advanced companies are presently entering a third stage: the use of technology not yet commercially proven. Examples include new pulping and bleaching processes, totally new equipment and radically different treatment technology. Some of these schemes are entering the pilot or demonstration plant phases. They are motivated by government or industry grants, a long-range desire to achieve environmental goals, improved product quality, expected economic advantage or sheer inventive drive.

Other broad environmental factors associated with the industry must not be ignored: Much is being done to improve forestry management; increasing attention of being given to the health, welfare and wellbeing of operating personnel; management is increasingly aware of environmental factors; there is greater cooperation with the public sector.

TRENDS IN QUANTITIES OF POLLUTANTS DISCHARGED

A major difficulty in the analysis of quantitative trends in the discharge of pollutants by the industry is the dearth of statistical data from various countries and the lack of a mechanism for national or even international comparison. This problem is compounded by the assorted monitoring and analytical techniques used. In many instances the information is not available.

There is little question that the quantity of pollutants discharged and emitted by the industry, per unit of production, has been progressively reduced over the years. It is possible to construct a modern pulp or paper mill with a water use of one-fifth to one-tenth of that of an older mill, with a concurrent reduction of associated pollutants.

In terms of total quantity of pollutants discharged, it is probable that there was a progressive increase up until about 1970 due to increased production. All major pulp and paper producing countries have projected a systematic reduction from 1970 onwards, despite increased productive capacity. The following table summarizes projections of the OECD study[1] of the estimated reduction of BOD and suspended solids between 1970 and 1975, notwithstanding increased production for selected major pulp and paper producing countries.

1- Pollution by the Pulp and Paper Industry - present situation and trends;
Organisation for Economic Co-operation and Development, Paris, 1973
Available from OECD Sales Agents.

Projected Reduction of Pollutants Between 1970 and 1975

Country	Reduction % Suspended Solids	Reduction % BOD_5
Canada	55	24
Finland	57	16
France	47	16
Germany, Fed. Rep.	13	17
Japan	47	37
Norway	18	10
Sweden	51	50
Switzerland	55	77
United Kingdom	33	17
USA	47	66

It must be recognized that these projections were made in 1971 when the data base was limited and, most importantly, at a time when there was rapid evolution in the formulation of national environmental policies. The data between countries, moreover, are not strictly comparable since at the time used for the reference year (1970), the programs in some countries were significantly more advanced than in others. In addition, the definition of the parameters BOD and suspended solids varies between countries.

Little information is available regarding achievement of these objectives. Factors which affect the actual timing of individual programs include market conditions, industry profitability, regulatory agency attitudes, money supply and technological developments. Without firm statistical data, it would seem that the OECD projections remain generally valid, although in some cases the 1975 target may have been somewhat postponed.

Insufficient basic data were available to the OECD group to make predictions on pollutant emissions to the atmosphere. However, it is certain that the same basic declining trend is apparent. For the developing countries, the situation is even less clear. It might be hypothesized that in view of the ever increasing need for improved efficiency, discharges and emissions are being reduced accordingly.

ADVANCED AND FUTURE TREATMENT TECHNOLOGY

Generally, measures so far taken by the industry to combat pollution have involved the application of proven technology. These methods have evolved gradually and, once proven, have been increasingly accepted. Even so, some techniques commonly practised today would have been deemed unfeasible a decade ago.

There are several mills in the world, principally making board products, that operate on almost totally closed water systems. One can foresee in the not too far distant future, paper mills making low grade products having essentially zero effluent discharge.

In the chemical pulp industry, the same goals, considered futile just a few years ago, are thought by some to be now on the horizon. Several sulphate pulp mills operate with almost totally closed water systems in the washing and screening areas, and bleaching technology is approaching the stage where water can be reduced to levels whereby the bleach plant effluent may be returned to the recovery cycle. At the same time, new problems develop, such as a build-up of impurities in the various liquor systems. Methods are being developed to combat these problems.

Increasing attention is being given to developments of less polluting pulping and bleaching techniques. Some pulping methods being developed eliminate the use of sulphur. For groundwood, generally used in the manufacture of newsprint, new systems are being tried to improve pulp strength characteristics, and thus reduce and possibly eliminate the need for chemical pulp addition now required for quality considerations.

In bleaching technology, sequences are being researched to eliminate or reduce the quantity of traditional bleaching chemicals used, and at the same time improve the quality of the bleachery effluent. Gas-phase bleaching and various forms of dynamic bleaching are also receiving increased attention.

Air pollution control techniques under study include various process changes, and improved scrubbers and precipitators.

In the wastewater treatment field, methods being developed include chemical treatment of effluents, alternative means of dewatering sludges, biological treatment variations, adsorption, reverse osmosis, and ion exchange.

While much pollution control research and development is being undertaken by the industry, in the pollution control field, there is a definite lack of a mechanism whereby data may be exchanged between countries, almost certainly resulting in duplication of effort and some inefficiency of application. While this maybe an oversimplification of an issue with many ramifications, there is perhaps a need for more data sharing between countries.

COST OF POLLUTION ABATEMENT

It must be recognised that it is becoming increasingly difficult to estimate the cost of pollution control systems. Traditionally, pollution control costs were those "over and above" those required for normal operation of a mill. Today, when environmental control measures are becoming increasingly integral with the production process, cost distinctions are becoming vague.

Despite this, environmental costs are a growing economic burden on the industry. The OECD report gave cost estimates for 1970 and 1975, expressed as 1970 costs, for water pollution control. These estimates were averaged over those countries where reasonable projections were available for various segments of the industry.

Projected Water Pollution Control Costs - Average for OECD Countries

(U.S.dollars/tonne, at 1970 cost level)

	Estimated costs	
	1970	1975
Semi-chemical	2.34	8.89
Sulphite pulp and paper	2.48	11.70
Non-integrated sulphate pulp	0.86	3.16
Integrated sulphate pulp and paper	1.31	5.52
Newsprint	0.64	2.63
Paper and board	1.08	3.04
Fibre building board	0.64	2.12

The OECD data were projected for those mills that were in operation in 1970. Air pollution control costs also were displayed for some countries and, although obviously varying by production category, were significant.

In 1972, EKONO[2] produced a report for the FAO Advisory Committee on Pulp and Paper entitled Study of Pulp and Paper Industry's Effluent Treatment. Typical costs were estimated for selected new mill cases for total treatment costs to provide different percentage levels of BOD_5 reduction:

Typical Costs of Water Pollution Control

(U.S. dollars/tonne at 1971 cost level)

	Percent BOD_5 Removal			
Case	60	85	90	98
1. 300 TPD bleached sulphate	3.6	5.0	9.2	14.6
2. 750 TPD bleached sulphate	3.1	3.6	7.4	12.0
3. 750 TPD unbleached sulphate and sack paper	2.5	3.4	5.8	8.4
4. 300 TPD coated fine paper	1.5	2.6	7.3	6.5
5. 300 TPD bleached sulphate and coated fine paper	4.2	5.2	10.0	16.2
6. 350 TPD groundwood-newsprint	1.9	3.6	5.6	7.7

The EKONO report stressed that the cost estimates were for typical new mills only. It is probable that to achieve the same level of treatment in different countries, somewhat different costs are involved. In individual instances, the difference would be substantial.

2- A Study of Pulp and Paper Industry's Effluent Treatment; prepared by EKONO Consulting Engineers for FAO Advisory Committee on Pulp and Paper, 13th Session, Rome, 15-16 May 1972. Available from FAO.

In addition to water and air pollution control costs, other environmental costs, such as modifications to forest management practices, improved working conditions, and the like, must also be recognised.

The capital investment required by the industry to install environmental protection facilities is substantial. The OECD report estimated that during the period 1971 - 75, approximately (U.S.) dollars 3,000 million, at the 1970 cost level, would be required by the pulp and paper industry in OECD countries, to finance pollution control facilities for those mills that were operating in 1970. The information, where available, indicated that approximately the same funds would be required for the second half of the decade.

When allowance is made for cost escalation, and for non-OECD countries, it may be estimated that the capital requirement for the worldwide pulp and paper industry to finance pollution control installations in this decade is about (U.S.) dollars 10,000 million.

A pertinent estimate made by OECD was that, for participating countries, the pulp industry would need some 40 percent more funds to finance pollution control investments, in addition to those needed for increased production capacity, between 1970 and 1980. The corresponding figure for newsprint was 20 percent and for paper and board, 10 percent. The industry clearly has potential difficulties in raising this capital.

Many governments have adopted measures to help industry meet environmental control programs at least in the transition phase. Such measures include:

- direct subsidies or grants;
- tax reliefs mostly in the form of accelerated write-offs;
- loans from public funds, usually with a preferential rate of interest.

The OECD report emphasized that benefits from subsidies vary widely between countries. The effect of these benefits may be enhanced by freeing additional funds for productive investment purposes.

IMPACT OF POLLUTION ABATEMENT ON THE INDUSTRY

The structure of the pulp and paper industry is such that normal market forces generate considerable effect on the short-term outlook. The industry is capital intensive and thus cannot easily trim production during times of low demand. When demand exceeds capacity, it is able to raise prices considerably, due to the low price elasticity of demand of paper products. Thus, unless demand and capacity are in balance, swings in product price may be anticipated.

Certain segments of the industry are more vulnerable than others to adverse market conditions. When the market is slack, older less-efficient mills have disporportionate difficulty competing economically. This is especially the case for the sulphite pulp industry, which may largely be substituted by sulphate pulp. Environmental control requirements merely add to their burden, and may be accelerating the closure of inefficient mills. In instances where the pulp or paper mill was the sole employer, local social disruptions are great.

Since environmental costs between various countries, and between mills within those countries, vary considerably, the point at which cost, or ultimately price, disparities become relevant in broad economic, or social, terms is difficult to define.

There seems to be wide disagreement as to whether costs of environmental control measures are significant to industry. Some facets of this argument include:

- Since the pulp and paper industry is so vulnerable to market forces, and segments of the industry are less stable than others, added environmental costs can only compound already difficult situation, particularly in the short term.
- It is becoming increasingly difficult for the industry to attract outside capital for productive investment purposes, let alone environmental expenditures. Pollution control requirements have thus taken internal capital for non-productive investments, resulting in decreased new production and hence better market conditions and greater profitability.
- The cost increases are relatively small, and spread over a long time period, and in any case environmental costs should not be viewed in isolation: there are many other, some flexible, factors which determine the selling cost - raw materials and chemicals, transportation, energy, labour, capital charges, taxes, duties, etc., several of which are widely different between and within countries. Pollution control costs are merely additional manufacturing costs, and their impact is indefinable.

There seems to be some validity in each of the above arguments. One says that environmental expenditures have hurt the industry; another, it has helped it; the third says there is no noticeable change.

It may be suggested, however, that those countries or mills which have less stringent pollution control programs or alternatively receive greater subsidies, enjoy a relative economic advantage, either through increased profitability or through the release of more funds for productive expenditure.

On the other hand, it may be argued that these countries will be placed in a less advantageous position if they have to increase the impetus of their programs. Conversely the countries which have the most stringent requirements, may be undertaking more than is strictly necessary to create an harmonious environment.

In the developing countries with existing mills, where the products are generally used within the countries, the problem of environmental protection is mainly an internal question, with curtailment of gross pollution the prime objective. Generally, however, these countries tend to be met importers of chemical pulp, and have to absorb any additional pollution control costs which may have been included in the product price.

In the future, the pulp and paper industry in developing countries is likely to reach the point whereby the products are marketed internationally. In the absence of specific environmental legislation, an environmental impact assessment may be undertaken in each instance for the complex, and the most suitable control measures developed. Pollution control costs are therefore likely to be generally less than for some of the developed countries where blanket pollution control legislation for the industry exists.

The costs of pollution control are becoming increasingly significant, both to the industry and to the consumer since costs will eventually be reflected in the product price. The resulting higher product prices give the consumer the choice of accepting them and suffering some financial hardship or of reducing his consumption of product. In either case it is necessary that the consumer make some sacrifice. The benefits, both direct and indirect, of application of environmental control measures are still poorly understood.

ASPECTS OF POSSIBLE INTERNATIONAL COOPERATION

It is apparent that the approach to environmental problems in the pulp and paper industry varies widely between nations. Insofar as many countries are still evolving legislative methodology and control techniques, while others are only considering them, the issue of closer international participation should be explored.

As a basis for discussion, the following topics may be useful in establishing closer international rapport regarding environmental problems associated with the pulp and paper industry.

1. Monitoring techniques and analytical procedures vary widely between nations. Since many countries have yet to establish uniform procedures, it would be desirable to develop standardized testing methods.

2. There is presently no formal mechanism for international exchange of statistical environmental data for the industry. In most countries, data collection methodology is only just being developed. If more exchange of statistical data is desirable, it may be useful to develop consistent procedures.

3. Pollution control techniques vary widely between countries, and there seems to be some duplication of research and development effort. A formal means of sharing technological information would be useful.

4. The philosophical approach to environmental legislation varies widely between countries. It would be helpful for those nations yet to develop specific environmental legislation to have better access to the rationale behind the various approaches used in other countries.

5. The impact on society of increased pollution control costs is still poorly understood and it may be questioned whether society is aware of the implications of certain environmental programs. Elucidation on this issue may thus be advantageous.

An aspect of the pulp and paper industry that has received little attention, is that from the environmental standpoint it is highly advanced. Usually when countries develop specific environmental legislation, this industry is amongst the first to receive attention.

This feature is especially significant to the global environmental movement since it is frequently used as an example when developing approaches for other industries. Much of this credit must go to the pulp and paper industry for its manifestation of its responsibilities. At the same time, this pioneering can entail potential difficulties. It is thus important that dialogue be encouraged.

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HOW TO ASSESS ENVIRONMENTAL IMPACTS

POLLUTION ABATEMENT CONTROL TECHNOLOGY

TECHNOLOGY TRANSFER MECHANISMS

Introductory Papers
prepared for UNEP
by
George R. Webster, P.E., U.S.A.

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HOW TO ASSESS ENVIRONMENTAL IMPACTS

The action of environmental impact reviews has proven very effective in providing in-depth review and emphasis to broader public objectives. Environmental impact statements bring project proposals out in the open, thereby enabling affected citizens or organizations the opportunity to challenge the proceeding project. Perphaps even more important, the process brings about projects of a higher standard, and raises the level of project performance.

In developing such a program of review and assessment of environmental impact statements, the process can become a bureaucratic maze of paper work and red tape. Nevertheless, it can expose the weaknesses of Governmental or company projects, halting some that are unjustified and improving others before they are completed.

Preparation of an environmental impact report (EIR) for all projects that "may" affect the environment should be required. The EIR was initially set up to protect the environment, however, it is now being used more broadly, as people realize that it can be a very effective planning tool.

The EIR, encompassing all environmental areas, provides a "test" of the project design. It is also effective for generatin measures for mitigating the adverse effects that cannot be

avoided. These measures might include a plan in case of chemical spills, design changes to reduce noise, shifting schedules to reduce traffic congestion, or adjusting stack height to insure that emissions do not reach local communities.

It is most important to realize that an EIR does not and should not judge whether or not a project should be approved. Its function is "telling it like it is," not giving opinions. The part where judgment enters into the report is in deciding how far to go in depth and breadth of subject matter to satisfy the review. This actually depends on the project size, sensitivity, and degree of opposition which could be encountered from his plan of construction. Any report investigation beyond what is needed is a waste of time and money.

The following is a suggested format to follow in preparing an EIR:

I. Summary

II. Introduction

III. Project description

IV. Environmental impact assessment

- 1.1 Environmental setting
- 1.2 Impact analysis
- 1.3 Unavoidable adverse impacts
- 1.4 Mitigating measures
- 1.5 Project alternatives

V. Relationships between short-term uses of man's environment and enhancement of long-term productivity

VI. Irreversible and irretrievable commitment of resources resulting from the proposed action

VII. Growth-including impacts of the proposed action

VIII. Boundaries of affected areas

The description of the project should contain the following information, but not in detail beyond that needed for evaluation and review of the environmental impact. (a) The precise location and boundaries of the proposed project should be shown on a detailed map (preferably topographic). The location should also appear on a regional map. (b) A statement of the objectives sought by the proposed project. (c) A general description of the project's technical, economic and environmental characteristics, considering principal engineering proposals and related public service facilities.

An EIR should include a description of the environment in the vicinity of the project from both a local and regional perspective. Knowledge of the regional setting is critical to the assessment of environmental impacts. Special emphasis should be placed on environmental resources that are rare or unique to that region. Specific reference to related projects, both public and private, both existent and planned, in the region should also be included for purposes of examining the possible cumulative impact of such projects.

All phases of a project must be considered when evaluating its impact on the environment: planning, acquisition, development and operation.

The direct and indirect impacts of the project on the environment should be described, giving due consideration to both short-term and long-term effects. It should include specifics of the area, the resources involved, physical changes, alternatives to ecological systems and changes induced in population distribution, population concentration, human use of the land (including commercial and residential development) and other aspects of the resources base such as water, scenic quality and public services.

Describe any mitigation measures written into the project plan to reduce significant adverse impacts to insignificant levels, and the basis for considering these levels acceptable. When a particular mitigation measure has been chosen from among several alternatives, reasons should be given for the selection.

Any known alternatives to the project, or to the location of the project, which could feasibly attain the basic objectives of the project, and why they were rejected in favor of the ultimate choice should be stated. The specific alternative of "no project" must also be evaluated along with the impact. Attention should be given to alternatives capable of mentally

adverse impacts, even if these alternatives substantially impede the attainment of the project objectives and are more costly.

The cumulative and long-term effects of the proposed project that adversely affect the state of the environment should be described in detail. Special attention should be given to impacts that narrow the range of beneficial uses of the environment or pose long-term risks to health or safety. In addition, the reasons why the proposed project is believed by the sponsor to be justified now, rather than reserving an option for further alternatives should be explained.

Uses of nonrenewable resources during the initial and continued phases of the project may be irreversible since a large commitment of such resources makes removal or nonuse thereafter unlikely. Primary impacts and secondary impacts generally commit future generations to similar uses. Also, irreversible damage can result from environmental accidents associated with the project. Irretrievable commitments of resources should be evaluated to assure that such current consumption is justified.

Describe the way in which the proposed project could foster economic or population growth, either directly or indirectly, in the surrounding environment. This should include projects that would remove obstacles to population growth. Increases in the population may further tax existing community service

facilities so consideration must be given to this impact. Also discuss the characteristic of some projects that may encourage and facilitate other activities that could significantly affect the environment. It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment.

Public sensitivity can lead to unwarrented law suits against a project. There is no secret to dealing with public sensitivity - all that is required is time and consideration.

The most important sections of an EIR are the summary, project description, environmental baseline, impact analysis, mitigating measures, and discussion of alternatives. All too frequently the alternatives are addressed lightly.

Also of great importance, and unfortunately, the most difficult aspect of the EIR process is that people look for quantification of environmental impacts to simplify their judgments of EIR adequacy. Whatever system is divised to compare the impact of various alternatives, much of the decision must be rather subjective.

POLLUTION ABATEMENT CONTROL TECHNOLOGY

In the United States, as elsewhere in the world, pollution from the pulp and paper industry, despite expanded output of products, is steadily decreasing.

A fact that is indicative of the relatively high capital investment required for the production of pulp and paper is that in the United States the pulp and paper industry is the fifth largest industry in value of assets, but only tenth in value of shipments of all manufactured goods.

This high capital investment has made it necessary to retrofit pollution abatement and control méasures in older mills rather than closing them and building new ones.

The problem of reducing pollution from old pulp and paper mills is one of the most vexing problems confronting the industry. Many mills were constructed during a period when pollution was not considered a serious problem, and of course the mills expanded as demands for their products increased. This resulted in sprawling complexes with multiple points of effluent discharge. They are a far cry from the compact, efficient, carefully designed units which the industry now designs and constructs. Currently, sites and operational designs for new mills are being carefully selected with the aim of minimizing the amount and effects of pollution.

The new mill, because of intense competition, will construct at a site that is optimum for markets as well as for labor, raw materials, water, power supplies, and for waste treatment and disposal.

In the case of the old mills, each can be improved by conventional abatement equipment, however, the degree of attainable improvement depends upon the specific mill, its location, and its technological age. Thus, each mill requires a solution for pollution essentially tailor-made to its particular situation. In some instances the tailor-made technology for old mills is not feasible, for various reasons including expense. Thus the industry frequently finds itself "on the horns of a dilemma" of old mill inflexibility and extremely high capital investment.

Paper has been made by hand in Europe for about seven-hundred years, but the "Industry" in its present form, as we know it, began a little over a century ago.

Surprisingly enough, during the last century the basic processes of this industry have undergone very few modifications compared to other industries. The size of operations has grown, effectiveness has been improved, working methods and machinery have been developed, but the fibrous vegetable raw material has to be debarked, defibered in the presence of water, whether mechanically, chemically or semi-chemically, with strong inorganic chemicals

(mainly alkaline sulphur compounds), cleaned and refined in the presence of water, transported to the paper machine in an aqueous suspension, and dewatered to obtain paper, paper board or other products. The only new item added has been the bleaching of pulp.

Water reuse has long been practiced in the industry for many reasons. One is to reduce water costs and a second is to reduce fiber and filler losses which, up to a point, decline with the degree of recirculation. Some of the other reasons are for the conservation of heat and chemical additives, such as sizings.

Pollutants thus normally occur in a highly dilute form, the ratio of water to pollutant varying from a few hundred to one, to several thousand to one. The removal of these dissolved or highly dispersed materials economically is the problem which defies a simple solution.

Wastes which are hazardous to human health may be termed "contaminated," and wastes which may render the receiving waters undesirable or unsuitable for other legitimate purposes such as drinking, fishing or swimming are called "polluted." Wastes from the pulp and paper manufacturing process, are nontoxic to humans and are termed polluted.

The major pollutional characteristics of pulp and paper mill emissions and wastes may be placed in three (3) classifications. These are Suspended Solids, Soluble Organics and Aesthetic Pollution.

Maximum collection and reuse of water and solids within the mill is the first step in reducing pollution. Flotation or vacuum save-alls are frequently used to recover and concentrate suspended solids. A large portion of the fibers and minerals reclaimed can be reused in the process, thus offsetting a portion of the cost of abatement. As the process is progressively closed and recirculation increased, certain existing problems are magnified and new problems develop.

Recirculation of water and fines, when carried too far, can lead to such difficulties as reducing drainage rates on the wire, increase in foaming, aggravated slime problems, and concentration of dirt in the finished product. The degree to which a mill system can be closed up is dependent on the importance of the various offsetting factors to the particular process and product. The ultimate chemical pulp and paper mill, operating with a closed water system, has yet to be developed.

Sedimentation is the principal method used to reduce suspended solids in mill effluent, however, materials so removed are usually not reusable.

Mechanically cleaned circular clarifiers have become the generally accepted facility for removal of suspended solids. Efficiencies of the units in removing total suspended solids from a pulp and paper mill usually range from 70 to 90 percent, while settleable solids are reduced by 95 percent.

The disposal of sludge is becoming a major problem. Two present methods are: (1) land disposal when large amounts of land are readily available; and (2) incineration as a last choice due to high operating costs and problems of operation.

The second principal area of pollution from the pulp and paper industry is soluble organics. Cellulose fiber is the only material desired from wood, yet approximately half of the wood is noncellulosic.

Soluble organic material contained in the process waste waters and expressed as BOD (Biochemical Oxygen Demand) is one of the most significant sources of pollution from all industry.

Stabilization basins or naturally aerated lagoons have been widely used for BOD reduction. If stabilization basins are favorably geographically and climatically located, they have distinct advantages of dependable performance, of being able to absorb wide variations in BOD load, and inexpensive operation.

Mechanically aerated basins are being looked to more and more as the solution to the BOD problem of this Industry. They have the advantages of stability of operation (6 to 10 times BOD loading capacity per acre of natural stabilization lagoons). Most common designs provide a retention time of from 6 to 10 days with provision included for supplementary feeding of nitrogen and phosphorus nutrients.

In installations where space is of major concern, activated sludge treatment or one of its many modifications is being utilized for biological treatment of wastes. An activated sludge basin will accomplish in 4 to 6 hours the same BOD reduction as a natural aeration basin achieves in 25 days' retention time or mechanically aerated basins in 6 days. The cost of these more sophisticated systems usually increases in the same mode and in using these processes the sensitivity increases and requires that the process be under the supervision and guidance of a trained operator. Besides sensitivity, the big disadvantage of the activated sludge process is the problem of disposal of the biological sludge. Probably no single phase of pollution abatement in the industry is subject to such intensive present research and development program as is secondary sludge thickening and disposal. The processes presently available are being refined and modified to meet special requirements and lower the relative high costs involved.

Utilization of spray irrigation or land disposal is one of the few methods in which BOD reduction may approach 100 percent. Where weak wastes are sprayed on the soil it is important to maintain a good crop of vegetation to keep the soil open or porous and facilitate transpiration or evaporation of the water. However, care must be taken to avoid flooding that can kill the vegetation.

Land disposal may also be effective for strong wastes, IF precautions are followed. Wastes of high specific gravity can lead to serious seepage problems, since they may go into the groundwater, substantially undiluted, and then move laterally along rock strata. For this reason spray irrigation disposal is usually preferred over flood techniques.

The use of end-of-pipe or external treatment techniques has been minimized in favor of internal production process modification controls by a number of countries. The combination of both concepts is, in my mind, required to achieve the desired ultimate maximum pollution abatement level.

The development of by-products, particularly from spent sulfite liquors, is one development having had a great deal of research and limited success. Torula yeast is a major by-product resulting from this research and is used as a food ingredient for a wide range of products. Many other products are possibilities, such

Ethyl alcohol and vanillin, but they usually require subsidy since the economics of production or breath of market are not favorable.

Lignosulfonates are used as binders in such things as animal feed pelletizing, linoleum paste, and wood product adhesives. They are also used as dispersants in oil well drilling muds and numerous other applications. The possibility of chemical by-product production is highly diversified, and the research continues for better uses for the "other half of the log."

Most air pollution problems in the pulp and paper industry are associated with the production of kraft pulp and to some lesser degree with the production of sulfite pulp.

The odor from kraft mills has, in the past, been a serious cause of complaints. The odorous sulfur compounds present the most difficulty. These sulfur compounds, present in pulp mill emissions, can be detected by the human nose at concentration levels of less than five ppb (parts per billion).

Sulfur dioxide in sufficiently high concentrations can cause corrosion and vegetation damage. The reaction of the pulping chemicals in particular sodium sulfide, with the methoxy groups of the lignin molecules constitutes the major origin of the odorous organic sulfur compounds. The major sources of odors are the digester and the recovery furnace.

Digester relief and blow gases contain methyl mercaptan, methy sulfide, methyl disulfide, and some hydrogen sulfide.

The concentration of volatile sulfur compounds is dependent upon the method ot venting the digester, the degree of cooling of the vapors, the cooking conditions, and the types of wood used.

In many large-scale installations the relief and blow gases are diluted with air and burned in the lime kiln.

Some mills react the evaporator non-condensables, consisting mostly of hydrogen sulfide, with white liquor to obtain noticeable increases in the sulfidity, especially if unoxidized black liquor is evaporated. The residual gas is piped to the digester gas combustion system.

Although raising the pH of the black liquor results in a noticeable reduction of hydrogen sulfide released, the most effective means of abatement is either the reaction of the sodium sulfide concentration to less than 0.2 gram per liter by oxidation, or the elimination of the direct contact evaporator.

The newer systems for black liquor oxidation, capable of handling either weak or strong black liquors, introduce air under pressure through a diffuser below the surface of the black liquor in a tank. The air is distributed through perforated plates, or through an air sparger below an agitator. The liquor retention

time ranges from 10 minutes to 2 hours, depending on the degree of air distribution and the Na_2S concentration. Most installations are equipped with mechanical defoamers, and sometimes use antifoam.

The air leaving the black liquor oxidation system, containing 5 to 100 ppm of sulfur compounds, is usually piped to the air intake of the recovery furnace or to the lime kiln.

Although black liquor oxidation reduces the losses of volatile sulfur compounds to a low level, it does not prevent the escape of significant quantities of organic material in the flue gas during the direct contact evaporation.

Elimination of direct contact evaporators by going to higher concentrations in the multi-effect evaporators or recovery boiler design changes is now required in most all new mills to meet air pollution requirements.

Although black liquor oxidation has a beneficial effect on the performance of direct contact evaporators, it is of little consequence as far as the recovery furnace performance is concerned.

Many furnaces are operated at more than their designed firing rate, which may result in incomplete combustion and contribute significantly to the emission of reduced sulfur compounds.

Dust particles in the recovery furnace flue gas are removed by electrostatic precipitators or venturi scrubber systems.

Newer kraft mills are being equipped with precipitators with rated efficiencies of greater than 99 percent. This results in residual dust loading of approximately 0.03 to 0.04 grain/scf of gas.

In installations using the venturi recovery unit, the units either present a higher pressure drop for the flue gas or use large quantities of water. Even though operating costs are higher than for the electrostatic precipitators, the treatment with water or a solution allows the simultaneous recovery of some of the volatiles and additional heat.

Older mills with overloaded or low-efficiency precipitators sometime install a venturi scrubber in series with the electrostatic precipitator. Pulp mills with salt problems will find that the sodium chloride tends to accumulate in the secondary scrubbing system.

The gas leaving the lime kiln can contain more than 100 ppm of hydrogen sulfide in addition to particulates consisting mostly of lime dust and sodium salts. Thorough washing of the lime mud and operation of the lime kiln with at least 2 percent residual oxygen effectively eliminates hydrogen sulfide emissions.

Most modern lime kiln scrubbers obtain 99 percent removal of lime dust.

Aesthetic pollution normally results from the dark color of treated waste water discharges from the kraft industry. In spite of extensive research, these types of aesthetic pollution presently can be only partially satisfied.

The color problem resulting from the production and bleaching of kraft pulp has a number of operational systems providing various levels of reduction. These systems in Sweden, France and the United States will be the nucleous of future systems development and utilization. These systems may be categorized as (1) the lime color precipitation techniques; (2) the resin absorbsion system; (3) the oxygen bleaching unit operations; and, (4) the reverse osmosis systems, together with activated carbon production and utilization research studies toward closed-loop water reuse systems. Extensive reports have been written on each of these areas.

Although there are wide differences in the degree of technology development of the paper industry in various areas of the world, the industry is nevertheless truly world wide in scope. World-wide expansion of the paper industry is largely dependent upon the development of local sources of fiber. Whereas the original basis of the wood pulp industry was the mechanical or chemical defibering of a few coniferous wood species, it has long ago

been necessary to utilize many wood species once considered unsuitable for pulp and to modify the pulping process to produce acceptable pulp from these wood sources.

Present industrial developments and research objectives such as non-sulfur chemical pulping processes and black liquor chemicals recovery techniques which replace the present recovery furnace and provide activated carbon for use in effluent treatment to achieve a nearly closed-loop water use system, will be closed followed by those wishing to minimize environmental pollution from the pulp and paper industry.

TECHNOLOGY TRANSFER MECHANISMS

Technology can be a solution to major business and social problems, but technological solutions take time. If technology is to be best used, the perception lag in recognizing a problem must be shortened, the problem recognition must be followed immediately by an active search for technological solutions. Future problems and needs must be discovered, and then active and creative technological applications must be uncovered. To sit back and assess where technology is and where it is taking us, is to give up our destiny with only token resistance. We must decide where technology can go and where we want it to take us. Aldous Huxley's Brave New World and Charlie Chaplin's Modern Times, the forerunners of Toffler's Future Shock, were commentaries on man's inability to handle the effects of technology. It's even truer today than ever before: technology must be managed now for tomorrow.

The changes needed to improve our pollution abatement technology management require the following. (1) To gain a better understanding of the process of technological change - what is only vaguely understood is likely to be mismanaged. (2) To reassess the current level and stock of technology constantly, to determine where additions are feasible and useful. (3) To evaluate ongoing technological research, to see where it is leading us. (4) To search for emerging or future problems that will either require technological solutions or significantly benefit from

them. (5) To supply such information to decisionmakers who can relate current and upcoming problems and technology to social priorities. (6) To design incentives to lead technological research in the direction that society determines through the political process and marketplace activities. (7) To develop a national and international strategy for managing our pollution abatement Research and Development efforts - in place of the piecemeal approach presently utilized.

Change has always been a part of the human condition. What is different today is the pace of change, and the prospect of its coming faster and faster.

A factor initiating cognitive change is change in the individual's information. But mere "exposure" to new information does not guarantee that the individual will pay attention to or accept the new information. Despite new information, his feelings, emotions, and wants may prevent cognitive change until he understands all others needs and wants.

Increasing international cooperation, in the pulp and paper industry, through international associations and agreements, are required. Faced with the knowledge of the forces shaping our society and the tensions and problems created, we must not only determine trends and projections for the future, but derive from them a plan of strategy. Reliability of information is the

key, and accuracy and impartiality of interpretation are essential for transformation into equitable and practical decisions and actions.

The means of transferring knowledge and ideas are base, some being more effective on a short time basis to "get things going" and some for long term use.

In determining the most effective means of communication or technology transfer we must remember that we want to make information available to all the men actually making the recommendations and decisions which are governing and operating the industry. It has become increasingly apparent that the information at meetings, like this one, is being diseminated only in a limited manner to those who attend the meetings and a select few others.

One suggestion is that perhaps the best means of advancing pollution abatement communication in the Pulp and Paper industry, would be a technology "clearing house" for this specific subject. This, of course, would not be an easy task, but one that could be most effective if properly coordinated through the United Nations Environmental Programme. Complete cooperation of involved governments and industrial trade associations to provide the basis of research and development priorities and results of all studies will be required. This information is only presently available in a few cases through programs organized by individual, governmental and industrial trade groups in specific countries.

Are there any other suggestions?

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U.N E.P.
Office of Industry

UNITED NATIONS
ENVIRONMENT PROGRAMME

FINDINGS ADOPTED BY THE PULP AND PAPER SEMINAR

INTRODUCTION

There is a broad base worldwide interest in the environment and quality of life. This is reflected in the developed nations' major effort to regulate and abate all forms of pollution. Developing nations are interested in environmental principles and in receiving assistance to aid them in planning their regulatory programmes.

The environmental movement has resulted in actions by the pulp and paper industry to develop sound management practices and increased productivity of the world's forests ; to develop and increasingly use new or improved manufacturing and pollution control technologies, in order to minimize the impact of their operations on the surrounding environment ; to establish significant waste paper recycling systems so as to extend the use of the world's resources and minimize solid waste disposal problems in large urban areas.

The delegates emphasized the important regulatory role of governments in establishing individual national rates of adoption of control technology. They further recognized the different requirements for environmental pollution, economic development and other social priorities existing around the world and therefore supported the concept that environmental standards were essentially national decisions.

Throughout the Seminar, there was a recurring theme of the complexity and diversity of the environmental protection situation in the industry. The need for greater dialogue was repeatedly stressed; at present, there are no formal mechanisms for multilateral sharing of information on technical and other

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aspects of the subject. While it is apparent that there are many viewpoints concerning the definition of pollution and the priorities that must be assigned to combat it, agreement was found on a number of subjects :

1- INDUSTRY/GOVERNMENT COOPERATION

It being recognized that, on environmental matters as in other respects, each country has its particular needs, goals and institutions, there was agreement on the desirability of close, continuing consultation and co-operation between industry and national governments in the development and administration of environmental policies and standards, the financing of pollution control equipment, the conduct of necessary research and the development and maintenance of well managed forests or other sources of fiber.

2- INTERNATIONAL COMPETITION

The risk of distortions in international competition has often been felt as a restraint on the implementation of environmental protection measures. A first study of this problem was made by the OECD in 1971-72, and published in 1973. The Seminar recommended that UNEP consider means for reviewing the situation periodically and for extending this review to a larger number of countries. If such a study reveals the possibility of trade distortions, an examination should be undertaken to judge whether a harmonization of policies of the countries concerned would be justified. It should be recognized that, while pollution control costs do tend to be reflected in production costs, many other factors determine the price of the product; disparities amongs countries in pollution control costs can hardly be examined in isolation.

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3- ENVIRONMENTAL LAWS AND REGULATIONS

It was not felt to be either possible or desirable to establish uniform environmental standards for all countries. Many different approaches to legislation and regulations specific to the pulp and paper industry have been developed by different countries. It would be useful particularly for countries introducing such regulations for the first time, to have ready access both to existing national legislation and regulations and to the rationales behind the differing approaches to regulation, the establishment of parameters and the setting of emission standards. Hopefully UNEP could assemble, classify and make such information available on a continuing basis.

4- ALLOCATION OF CAPITAL

Environmental expenditures will compete with production capacity for the same limited capital funds. Decisions on environmental requirements should therefore be made at the national level and result from a balancing of the equally important requirements for environmental protection, creation of employment and other social benefits.

5- FINANCING

In the past, subsidies to the pulp and paper industry have taken several forms -whether as direct monetary assistance or in non-monetary forms such as the misuse of environmental resources. The need for very substantial capital to retrofit old plants and include such equipment within new plants was noted and was examined in the context of the world-wide shortage of capital. It was realized that difficulty of financing is particularly acute in the developing countries. It was therefore suggested that relief from

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import duties and taxes on pollution abatement equipment and the provision of assistance on capital formation techniques would be desirable. Additionally, the particular need for finance for pre-investment studies was emphasized. It was recognized that various means of financing have been successfully adopted by various countries and that UNEP could usefully facilitate the exchange of information on such methods.

6- DEVELOPING COUNTRIES - ESTABLISHMENT OF REGULATORY SYSTEMS

It was recognized that the developing countries are looking for assistance on the preparation, execution and analysis of environmental impact assessments; the development of appropriate standard methods for sampling, monitoring and measurement; the identification of parameters to be taken into consideration when planning environmental control measures; and the mechanism to implement regulatory systems. Scarcity of capital was recognized as being of special concern to the developing countries and as underlining the importance of establishing appropriate analytical tools to determine trade-offs between types of pollution, levels of emissions, type and costs of pollution control equipment and efficiencies of performance. UNEP could undertake this task in collaboration with international agencies, governments and the industry.

7- DEVELOPING COUNTRIES - EXCHANGE OF TECHNICAL INFORMATION

The importance of increasing exchange of technical information within the pulp and paper industry and among governments through international organizations was recognized and it was particularly felt that the dissemination of such information and knowledge to the developing countries should be greatly encouraged. Much of the pioneering development work in the environmental field has been undertaken by the pulp and paper industry in the

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industrialized countries and, faced with knowledge that duplication of this work in the developing world would be costly and time wasting, it was suggested that interchange of information and ideas on the means of advancing pollution abatement in the pulp and paper industry could be most effectively met by UNEP.

Facilitating the attendance of representatives of developing countries at technical meetings on environmental technology held in the developed countries at fairly regular intervals is one possible way UNEP could help information transfer and development of independent environmental capability in developing countries.

8- ECONOMIC AND ENVIRONMENTAL ANALYSIS

Recent developments of input-output analysis which permit the incorporation of variables relating to environmental considerations and pollution control could well be useful as an additional analytical tool of benefit for governments and the pulp and paper industry.

9- MONITORING AND ANALYTICAL METHODS

Sampling and monitoring techniques and analytical methodology often vary widely between and within countries. This fact creates difficulties in comparing and assessing the effects of national policies and legislation. As far as possible, the maximum possible use of common measurement techniques is desirable, particularly for developing countries. Projects to develop common standard analytical techniques are underway by ISO and by a joint Scandinavian task force. A possible distinction is recognized between test methods to be used for control of pollution abatement processes and those required for regulatory control.

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It was further recognized that part of the reason for present multiple methods lies in basic differences of opinion of what is the proper parameter to measure. Until there is common agreement on this question, some multiplicity seems unavoidable.

Progress in analyzing and resolving these questions could be facilitated through the auspices of UNEP.

10- POLLUTION CONTROL TECHNOLOGY

Rapid developments are presently occuring in the technology of pollution abatement. Costly research and development programmes are underway in many countries. It would be useful to industry and governments, in both developed and developing countries, for some formal mechanism of sharing this information to be established, whilst respecting any proprietory rights that may exist. This could be a function of UNEP.

At the Seminar, a summary report was presented of work currently in progress in Sweden, Finland, Norway, Canada and the U.S.A. Results of this ongoing research will be made available to UNEP.

A list of contacts in the individual countries through whom information may be requested is attached.

FAO and UNIDO reported that they are familiar with the above programmes and those in other developed countries and offered this information on request to any developing country.

11- A RENEWABLE RESOURCE

The pulp, paper and paper board industries are based on a renewable raw material. The industry's high capital intensity and the long life of its

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manufacturing facilities create an economic incentive to develop and maintain well managed forests or other sources of fibre, to ensure adequate and stable supply of raw materials over the life of the manufacturing facility. In developing countries, the development of a pulp and paper industry creates improved values for forest resources where none previously existed and can thereby provide the essential economic incentive to encourage development of sound forest management practices. Such a move inevitably creates employment, raises standards of living and can, if wisely managed, improve the environmental protection and renewal of resources over a wide area.

12- RESOURCE SUPPLY

Current forecasts of future worldwide demand and capacity for pulp, paper and paper board indicate that in the years ahead the potential demand will be in excess of the currently projected capacity. The projected shortfalls will be unevenly distributed geographically and proportionately most severe in developing countries. A primary constraint which may prevent a balancing of supply and demand is the lack of adequate capital or adequate return on capital to provide the necessary new manufacturing facilities. Although availability of adequate fibre resources will be a local limiting factor in some countries, there will be an adequate supply of wood on a worldwide basis well into the future and numerous unexploited opportunities exist to increase the available reserves. Many countries will, of course, utilize other available fibrous materials in ways appropriate to the particular situation of each country. The Seminar emphasized the need for proper management as an essential aspect of a balanced national development programme.

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13- RECYCLED PAPER

Recycled paper will continue to play an important role in all countries, not only in those which lack natural resources or those which are heavy importers of pulp and paper. This will occur not only for environmental reasons, but also because recycled paper is an important source of fibrous raw material.

Certain problems have to be recognized when attempting to increase the use of recycled paper, including technological and quality considerations as well as the methods and cost of collection. Growing problems of solid waste disposal in large urban areas must also be taken into consideration.

14- THE MARITIME ENVIRONMENT

The maritime environment is a close environment the preservation of which is essential for mankind. The Seminar expressed the wish that discharges from pulp and paper industries into the maritime environment be regulated as proposed by the 1972 Stockholm Conference and that the effluents to be released therein be purified as necessary before release.

15- THE WORKING ENVIRONMENT

The Seminar recognized that adequate pollution control in the working environment in the pulp and paper industry was an essential feature for safeguarding health at work and for ensuring the well-being of the workers concerned. It stressed the fact that the employer is generally responsible for applying adequate technical and organizational measures to maintain within safe limits the exposure of workers to atmospheric pollutants and to noise and vibrations. It also underlined the obligation of workers to strictly observe the factory safety rules, which could possibly be mutually

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agreed upon between management and the workers themselves. The Seminar stressed the fact that a working environment pollution control programme could only be successful provided full involvement on the part of both management and workers was secured. The Seminar further recognized the need for operators and supervisors to fully comprehend the use of the machinery. The incorporation of ergonomical features in its design was considered most desirable. The shortage of qualified technical, skilled and semi-skilled staff was a serious problem in many regions and the Seminar underlined the need to promote the setting up of more teaching facilities and programmes.

16- PUBLIC HEALTH TRENDS

The meeting was aware that a number of chemical and physical factors pose a health problem both to workers and to the general public. Noise, both within the plant and at the periphery, was the most important factor and many countries have already passed regulations, but in other countries the initiative is left to the industry. The collection of information on harmful noise levels, the monitoring of hearing loss and the keeping of records are advisable and the need to exchange information on this process was stressed. Other health problems relate to odors and the oxides of sulphur and nitrogen. On odors, much information is already available in some countries and some industrial groups. More research is, however, needed on the effects of oxides of sulphur and nitrogen and the mechanisms of their action on the human body. The working population and the general public are very aware of health hazards and press for measures against adverse environmental conditions. A more rational approach to the problem is needed which is based on scientific information rather than uninformed opinion. Only in this way is it possible to arrive at balanced measures for the control of pollution.

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Much scientific and practical health information is available and should be collected and classified for the benefit of all countries, and particularly the developing countries. Industry and professional bodies often have more knowledge at their disposal than public agencies and it is essential that such information be made available.

UNEP should continue supporting the development of environmental health criteria for substances of concern to the industry and noted that noise and the oxides of sulphur and nitrogen are priority subjects in this programme. Internationally agreed scientifically based criteria will facilitate an on-going process of information and discussion between government, industry, labour and the general public. Such information and discussion will facilitate planning of regulatory action at the national level and can thus lead to balanced investment decisions.

LEGISLATIVE APPROACHES

The Seminar suggested that governments, when considering antipollution legislation, take into account, in addition to environmental protection considerations, problems of different types of industries, the difference between new and existing mills and the efficiency of available antipollution equipment. It was noted that it is desirable for environmental parameters to be expressed as "process weight" units rather than as concentration units for regulatory purposes.

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CONCLUSION

The Seminar concluded that :

- Efforts to improve the environment must continue within the pulp and paper industry ;

- The industry will need increasingly to develop low waste and where possible non-waste technologies together with low energy-consuming production methods ;

- Such a programme must avoid unnecessary and unreasonable burdens on the industry and can most effectively be based upon the principle that the best practicable means should be used in dealing with the environmental problems of the industry;

- A global environmental approach should be adopted when constraints and control measures are pllied, thus always ensuring that economic and social factors are taken into consideration.

APPENDIX : Contact addresses on information for research and development information.

UNEP

Office of Industry

UNITED NATIONS

ENVIRONMENT PROGRAMME

REPORT

on the Pulp and Paper Seminar

Paris, 19-21 March, 1975

1. The United Nations Environment Programme Seminar on environment and conservation in the international pulp and paper industry was held in Paris on March 19-21, 1975 at the office of the I. B. R. D. (World Bank). The meeting was convened by the Executive Director of UNEP in accordance with the instructions of the Governing Council in decisions I (1), Section IV (c) and 8 (II) (Section III), paragraph 3, on the development of an on-going consultative relationship with industry.

2. It was the first in a series of industry sectorial seminars conducted as part of an environmental consultative process between UNEP and industry. Fifty-three highly qualified officials, executives and experts attended the seminar, representing international organizations and industry and a number of specislists were seconded from governments for the meeting. A group of ten observers from other sectors of industry was also present. The list of participants is appended hereto (Annex 1).

3. The meeting was called to examine environmental and conservation developments in the pulp and paper industry and to explore ways in which environmental progress can be encouraged at the international level.

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The proceedings were based on an agenda drafted by the Office of Industry in consultations with representatives of the industry, with governments and other international agencies. Following UNEP policy to cooperate with other agencies but not to duplicate their efforts, these agencies were closely involved in the preparations for, and in the conduct of the Seminar. Their contributions were augmented by generous assistance from governments of principal pulp and paper producing nations.

4. The participants had received, prior to the Seminar, an annotated agenda and three introductory reports appended hereto under number 2, 3, 4 and 5.

5. On behalf of Mr. Maurice Strong, the Director of Industry welcomed the participants and made some opening remarks (Annex 6). The proceedings then adhered closely to the annotated agenda (document 2 above) and, after discussion, the Seminar accepted the three introductory reports.

6. At the beginning of the afternoon session of 20 March, Mr. Maurice Strong, Executive Director of UNEP, addressed the participants. He stressed the importance of a global environmental approach and, for each industrial sector, of some universal guidelines. He underlined the need for a close collaboration between UNEP, other international agencies, governments and industry. He also stressed the necessity of paying increased attention to the constraints of developing countries and underlined the advisability for industry to participate in an on-going process of research on the general problems of ecodevelopment.

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7. A reporting committee was formed to assist the rapporteur in the drafting of the findings which were unanimously adopted during the final session of the Seminar.

8. The Seminar findings reflect the results of nearly three days of intensive often controversial discussion by this unique assembly of qualified people drawn from numerous countries and organizations.

They concluded broadly :

8.1. improvement of the human environment and conservation of the earth's resources must continue in industrial and developing countries ;

8.2. such improvement should be accomplished without unreasonable or unnecessary burdens on industry which has other important economic and social functions ;

8.3. emphasis should be placed on continuing improvement in low waste and low energy-consuming technology and on exchange of this advancing technology ;

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8.4. the developing countries require and want assistance on pollution abatement, on natural resource conservation and on the increase of pulp and paper production ;

8.5. UNEP has a unique and important role to play at the international level in furthering environment and conservation activity in this industry.

9. The Seminar, in recording its findings, selected eight follow-up activities for UNEP :

9.1. to assemble, classify and disseminate information about national regulations in the pulp and paper industry. Also to determine the rationales behind differing national approaches to regulatory programmes, to the establishment of parameters and methodology and the setting of emission standards. The OECD published in 1973 a study on possible distortions in international competition resulting from differing national environmental protection measures. It was suggested that UNEP cooperate with OECD in considering means for updating this report and extending it to a larger number of countries.

9.2. to undertake a project for the interchange of information and ideas on means of advancing pollution abatement in the pulp and paper industry, with particular emphasis on advancing technologies and new research findings.
Further, to explore the possibility of undertaking joint research

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projects to share the heavy costs of such work while reducing duplication of effort.

9.3. to devise a mechanism whereby the non-proprietory information generated by such research programmes can be made available to developing countries.

9.4. to assist developing countries to make optimum use of their scarce capital in pulp and paper industry investments by gathering and disseminating information on analytical methods and management tools for determining and evaluating trade offs between types of pollution, levels of emissions and types and costs of pollution control equipment.

9.5. to further assist developing countries by facilitating exchange of information on successful methods of pre-investment studies as well as advantageous financing of complete pulp and paper projects.

9.6. to cooperate with the International Standards Organization, with the joint Scandinavian paper industry task force and other organizations in efforts to develop common standards for monitoring and analytical techniques. Such standardization would be widely useful but would be particularly welcomed by developing countries.

9.7. to encourage consideration by governments and international agencies of the importance of forest management together with the creation of environmental sound pulp and paper industries as a means of meeting

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growing paper needs while utilizing marginal agricultural lands for producing an important renewable resource, of creating employment, of stabilizing and improving the soil and regulating watersheds in certain developing countries.

9.8. to extend UNEP's initiatives and support of development of environmental health criteria to cover fully substances of concern to the pulp and paper industry. UNEP should, in addition, facilitate the dialogue on environmental health between governments, industry labour and the general public thereby facilitating the harmonizing of the planning stage of regulatory action at the national level.

10. These Seminar follow-up activities are submitted by the Office of Industry to the Executive Director for consideration. To provide guidance and assistance in arranging such activities, it was proposed to the Seminar that a steering committee of representative participants from governments, international agencies and industry be formed. This would ensure the continuity and the attention to the recommended follow-up action that the Seminar believed to be necessary. The steering group would be geographically representative and would give special attention to the problems and the opportunities in developing countries. However, the Seminar felt that such a decision fell within the competence of UNEP's Governing Council.

11. The full text of the findings adopted by the Seminar is appended (Annex 7).

U.N.E.P.
Office of Industry

Appendix

CONTACT ADDRESSES ON INFORMATION AND DEVELOPMENT INFORMATION

CANADA: Mr. R. J. Neale, Canadian Forestry Service, CPAR Secretariat, Environment Canada, Ottawa (Ontario) Canada K1A OH3
(for information on reports produced under the Co-operative Pollution Abatement Research (CPAR) Program funded by the Government of Canada. On receipt of project report summaries, individuals may request specific reports).

Director, Technology Development Branch, Water Pollution Control Directorate, Environmental Protection Service,
Environment Canada, Ottawa (Ontario) Canada K1A OH3
(for the Technology Transfer Program's periodic reports on specialized problems, studies, processes, etc. in many fields, including the pulp and paper industry; these reports can be obtained free of charge and a list is also available).

Pulp and Paper Research Institute of Canada
St John's Blvd., Pointe Claire (P. Q.)
(for reports on work carried out by the Institute).

FINLAND: Finnish Pulp and Paper Research Institute (Keskuslaboratorio)
P. O. Box 10136, 00101 Helsinki 10.

National Board of Waters (Vesihallitus)
Technological Research Office, P. O. Box 250, 00101 Helsinki 10.

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FRANCE: Centre Technique des Papiers, Cartons et Celluloses
154, Bd. Haussmann, 75008-Paris

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Monsieur Henry Robert, G. E. C.
5, rue Jean Mermoz, 75008-Paris

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SWEDEN: Swedish Water and Air Protection Research Institute,
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Fack, 17120 Solna 1

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Millbank Tower, Millbank, London S. W. 1
(for general information)

Marine Laboratory
Victoria Road, Aberdeen, Scotland.
(degradation of effluent in marine water)

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Water Pollution Research Laboratory,
Stevenage, Hertfordshire
(effluent in fresh water and sewage)

Research Association for the paper, board, printing and packaging industries, Randalls Road, Leatherhead, Surrey

Warring Spring Laboratory, Stevenage, Hertforshire
(air pollution, waste paper separation from general waste)

National Engineering Laboratory, East Kilbride
(engineering aspects of noise).

UNITED STATES:

Mr. William J. Lacy P. E., Director, Industrial Pollution Control Division, Environmental Protection Agency, Washington D. C. 20460.
(for Research Development and Demonstration activity sponsored by EPA)

National Council of the Paper Industry for Air and Stream Improvement Inc.
260 Madison Avenue, New York, N. Y. 10016 (attention: E. J. Bolduc)
(an index of past Technical Bulletins is available. Individual reports are available at nominal charge).

The Institute of Paper Chemistry
P. O. Box 498, Appleton, Wisconsin 54910.
(subscription service is available for pollution bibliographies. Research projects are published in technical journals on completion).

Research projects are also carried out with industry sponsorship at the following universities : Syracuse, N. Carolina State, Western Michigan, Miami University of Ohio, University of Maine, University of Washington. All researchers publish results in professional technical journals on completion.

U.N.E.P.
Office of Industry

UNITED NATIONS
ENVIRONMENT PROGRAMME

PULP AND PAPER SEMINAR

Paris, 19-20-21 March, 1975

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