COMMISSION OF THE EUROPEAN COMMUNITIES

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PROPOSAL FOR A COUNCIL DIRECTIVE

ON THE REDUCTION OF WATER POLLUTION CAUSED BY WOOD PULP MILLS IN THE MEMBER STATES

(submitted by the Commission to the Council)

EXPLANATORY MEMORANDUM

I. COMMENTS ON THE PROPOSED DIRECTIVE

1. This directive is presented as a measure of harmonization of national legislations and an administrative action to be carried out within the framework of the European Communities' Programme of Action on the Environment (1). The Programme requires that particular attention be paid to industrial activities in which the manufacturing processes entail the introduction of pollutants into the environment and more specifically into the Community's inland and coastal waters. The Commission was charged with the task of carrying out studies of certain such industrial sectors, which would permit the exact nature of the pollution problems to be established, the best technical and economic solutions to be found and the concession of any financial aid requested to be harmonized, without prejudice to the application of Article 92 et seq. of the Treaty establishing the European Economic Community.

   The pulp sector of the paper and pulp industry was regarded as a matter of priority, due to the potentially highly polluting nature of the manufacturing processes used.

   The most urgent environmental problem for this sector is that of water pollution, and its prevention is the main objective of the annexed draft directive. However, it should be pointed out that air and soil pollution are also generated by pulp mills, but their environmental impact is considered to be less serious. The Commission reserves the right to present appropriate proposals in the future on forms of pollution other than that of water.

2. The Commission's study of the pollution problems in this sector entitled "Pollution by the Pulp Industry within the EEC" - which is annexed - has shown the following situation to exist :

   Pulp mill effluent can contain appreciable quantities of suspended

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(1) OJ N° C 112, 20.12.1973

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solids, can severely deplete the oxygen content of the receiving watercourse, can contain toxic substances, and can colour and cause foaming in the receiving watercourse. Whether or not this potential to pollute is realized, however, will depend on :

- the type of pulp producing process employed ;
- the volume and type of discharge ;
- the environmental characteristics of the receiving medium ;
- the extent to which Member States have established legislation controlling the discharge of waste.

In terms of BOD_5 and suspended solids which are the units most commonly used to define water pollution from pulp mills, the worst pollution problems are likely to arise in the sulphite pulping process : for a sulphite mill with standard 1970 technology (not taking into account the effects of external control measures) the effluent can have a pollution load of 450 kg/ton BOD_5 and 60 kg/ton suspended solids. Such a pollution load can be seen to be substantial when compared with the kraft process of pulping, in which recovery of liquor often takes place. In the latter case the pollution loads can be as low as 40 kg/ton BOD_5 and 10 kg/ton suspended solids.

3. To date few member countries have drawn up legislation which can be specifically applied to the discharge of pulp mill effluent. In Belgium, environmental quality standards specifically applicable to this industry have been drawn up and in France an agreement, namely the Contrat de Branche between the (then) Ministry of Culture and Environment and the French Confederation of Paper, Board and Cellulose Industries, was signed in June 1972. Germany is proposing to levy charges on the release of noxious effluents. Most other countries employ "guidelines" which are part of the general environmental legislation.

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Table 1.1.

PLANT SIZE IN THE PULP INDUSTRY

1972

COUNTRY	Less than 5000 tonnes p.a.	5000-10000 tonnes p.a	10000-25000 tonnes p.a.	25000-50000 tonnes p.a.	50000-100000 tonnes p.a.	over 100000 tonnes p.a.	TOTAL
BELGIUM/LUX.	1	1	1	2	-	2	7
DENMARK	-	1	3	-	1	-	5
GERMANY	17	8	10	8	9	3	55
FRANCE	14	3	6	10	8	6	47
IRELAND	-	-	1	-	-	-	1
ITALY(1)	33	10	18	5	6	3	75
NETHERLANDS	4	1	5	4	-	1	16
U. K.	-	-	2	2	2	1	7
COMMUNITY	69	24	47	31	26	16	213

(1) Number of enterprises

Source : European Confederation of the Pulp, Paper and Board Industries (CEPAC)

These differences in legislation and administrative actions may lead to financial charges differing from one Member State to another, and thus could distort competition and create a barrier to the proper functioning of the common market.

4. There are numerous technologies available for reducing the pollution load of pulp mill effluent. They can take the form of internal measures (i.e. measures which reduce the causes of pollution at their origin by modifying the manufacturing process) or external measures (i.e. treatment of effluent discharged during and after the manufacture of pulp). While these technologies can remove over 95 % of the effluents' oxygen demand and suspended solids content, their installation will require existing industry to incur extra costs.

For some sulphite and semi-chemical mills in particular, the establishment of certain of these technologies could involve substantial costs which could be cause for significant concern.

This then is the situation which the Commission has had to consider.

5. In preparing its proposals for a directive, the Commission has been guided by the general principles defined in the Communities' "Programme of Action on the Environment" (Part I, Title II). It was stressed in particular that :
"The best environmental policy consists in preventing the creation of pollution or nuisances at source, rather than subsequently trying to counteract their effects".

It was also stressed that :
"Major aspects of environmental policy in individual countries must no longer be planned and implemented in isolation. On the basis of a common long-term concept, national programmes in these fields should be coordinated, and national policies harmonized within the Community."

In the Commission's view coordination and harmonization of policies in the case of the pulp industry must initially mean the establishment of certain minimum effluent emission limits, which are technically feasible and economically realistic and which would represent an important first step in the protection of the environment.

The Commission therefore proposes the adoption, on a Community basis, of minimum emission standards for the pulp industry, according to the type of manufacturing process employed.

To allow the assimilative capacity of the receiving waters to be nevertheless taken into account - as well as appropriate water quality criteria and local social and economic conditions - a certain measure of flexibility in applying the proposed standards is provided for. Specifically, provided that in the case of already existing plants the basic emission standards are achieved by the end of a ten year period, Member States should be free within that period to work out a programme of pollution reduction, case by case, which takes into account all the necessary factors, both economic and environmental. Besides having the possibility of varying the timing of the pollution reduction programme, it should of course also be open to Member States to impose effluent limits which are more severe than these basic standards, where local conditions call for this. In the case of new plants, as well as new capacity which is added to already existing plants, the limit within which the effluent discharge values of Table 1 should be respected would be twelve months at the latest after the date the plant comes into operation. The assimilative capacity of tidal waters can be substantially different from those of rivers, and the parameters which determine the effects of effluent discharge into such waters might not be the same as in the case of rivers. It is therefore proposed that those existing mills whose discharge into tidal waters causes no appreciable damage to the environment, may be exempt from compliance with the discharge norms shown in Table 1 - which is identical to the Annex in the draft Directive.

A Member State may thus allow individual exceptions to the discharge norms in Table 1, for existing mills, if it considers the above criteria to be satisfied. However, each exception accorded expires, automatically, 5 years at most after the date of its concession.

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The possibility of a subsequent exception should be considered by the appropriate governmental authority, bearing in mind any changes in the quantity and characteristics of the effluent discharged by the installation in question as well as by other sources of pollution in the region, developments in the economics and technology of pollution control, and the actual environmental characteristics and requirements of the receiving waters.

The programme of action also states that :
"The cost of preventing and eliminating nuisances must, in principle, be borne by the polluter. However, there may be certain exceptions and special arrangements, in particular for transitional periods, provided that they cause no significant distortion to international trade and investment".

The Commission recognizes that the application of the proposed discharge norms may in some instances cause undesirable economic problems. and necessitate certain special aids. It has made a communication to Member States on this subject (SEC (74) 4264).

6. Commentary on certain essential elements of the directive :

Minimum emission standards.

These standards are set out in the table below. They are differentiated according to the type of process (as noted above, the pollution problems vary according to the process). They are differentiated also according to the type of treatment used. For example the proposed norms for the discharge of suspended solids vary according to whether or not aerated lagoons are available for the reduction of oxidizable matter.

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T A B L E 1

TYPE OF PROCESS		A	B (1)	B (1)
		SS Kg/t (2)	BOD_5 Kg/t (2)	SS Kg/t (2)
Kraft	unbleached	2,5	5	10
	Bleached	10	9	20
Bi-Sulphite	With elimination or re-utilisation of waste liquors	12.5	45	50
	Without elimination or re-utilisation of waste liquors	15	80	85
mi-chemical	Production capacity > 150 tons/day	5	8	5
	Production capacity < 150 tons/day	13	60	60
Mechanical		5	5	5

(1) biological treatment by aerated lagoon.

(2) the BOD_5 and suspended solids content may also be measured in terms of concentration (e.g. mg per litre of effluent), but in this case, the water consumption per ton of pulp manufactured must also be measured, so that the pollution load can finally be expressed in Kg/ton of pulp.

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On the basis of the data available to the Commission it appears that the additional costs required to achieve the proposed discharge levels could be quite low relative to the increase in the costs of other factors of production which have taken place in recent years. Using 1970 cost data in the case of bleached kraft pulp, for example, the increase in costs could be less than 5 %, and in the case of the sulphite and semi-chemical categories the cost increase could be of the order of 10 %, according to the appended technical annex These cost increases assume a base level of no controls. However, it seems likely that the percentage of costs accounted for by the required anti-pollution measures would presently be lower than above, because the price of pulp has risen very much more rapidly, since 1970, than the cost of the appropriate pollution control equipment.

7. Technology

The Commission is presently considering whether the need exists for action at the Community level on research and development in the field of pollution control technology for the pulp manufacturing sector. It will submit a separate paper on this problem as soon as possible.

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8. The draft Directive which follows is based on Article 100 of the Treaty establishing the European Economic Community, is intended to harmonize legislation and administrative action and thus create a coherent system of legal provisions applicable in all Member States.

9. Before drafting this proposal the Commission has consulted a working group of national experts in this field, which met three times, and a group of experts from the Member States pulp industry which met once.

II. CONSULTATION WITH THE EUROPEAN PARLIAMENT AND THE ECONOMIC AND SOCIAL COMMITTEE

The opinion of these two institutions is required, pursuant to Article 100 (2) of the Treaty establishing the European Economic Community.

PROPOSAL FOR A COUNCIL DIRECTIVE
ON THE REDUCTION OF WATER POLLUTION CAUSED
BY PULP MILLS IN THE MEMBER STATES

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 100 thereof;

Having regard to the proposal from the Commission;

Having regard to the Opinion of the European Parliament;

Having regard to the Opinion of the Economic and Social Committee;

Whereas, motivated by the concern constantly to protect and improve the environment, some Member States have already taken and others are about to take measures to cleanse their water; whereas these measures include technical requirements with regard to the discharge of pollutants, with which pulp mills must comply;

Whereas national laws concerning the reduction of water pollution caused by pulp mills vary from one Member State to another; whereas these differences affect the conditions of competition within the Community and therefore have a direct effect on the operation of the common market

Whereas the Programme of Action of the European Communities on the Environment[1] provides for specific action in certain industrial sectors, including the pulp industry, with a view to reducing

[1] OJ No C 112, 20 December 1973.

at source the various forms of pollution caused by the sector under consideration;

Whereas, in order to protect the water of the Community, it is necessary to provide for discharges of pollutants to be reduced to certain levels; whereas these levels must be reached by existing establishments within a maximum of ten years from the entry into force of the Directive;

Whereas new establishments and new capacity added to existing establishments must use anti-pollution techniques in such a way as to reach the above-mentioned levels within not more than twelve months following their entry into service; whereas such action is in the interest of the protection of the environment;

Whereas it should be possible to allow derogations from the standards laid down in the Annex hereto where the discharges effected by existing establishments into coastal waters or into tidal parts of estuaries do not cause an appreciable deterioration in the quality of such waters;

Whereas the technical requirements set out in the Annex to this Directive will have to be adapted rapidly to technical progress; whereas, in order to facilitate implementation of the measures required for this purpose, a procedure should be laid down to ensure close cooperation between the Member States and the Commission within a Committee for the adaptation of this Directive to technical progress;

HAS ADOPTED THIS DIRECTIVE:

Article 1

1. This Directive concerns the reduction of water pollution caused by both new and existing pulp mills.

2. For the purposes of this Directive:

- "water" means all fresh water, whether running or stagnant, underground water, brackish water, estuaries and coastal waters;
- " pulp mill" means any establishment producing, whether exclusively or not, pulp
- "existing establishment" means a wood pulp mill which is in operation on the date of entry into force of this Directive;
- "new establishment" means a pulp mill which starts operation after the entry into force of this Directive.

Article 2

1. The pollution caused by existing establishments shall be reduced to the levels shown in the table contained in the Annex to this Directive, which forms an integral part thereof. Such reduction must be achieved within not more than ten years from the entry into force of this Directive.

2. The reduction shall be so phased as to take account of its effects on the competitive position of the undertakings concerned, which could have undesirable economic or social repercussions.

Article 3

In the case of new establishments and new capacity added to existing establishments, not later than twelve months following their entry into service the permitted level of pollution in the effluents shall not exceed the standards laid down in the Annex.

Article 4

1. Member States may permit derogations from the standards laid down in the Annex hereto where discharges effected by existing establishments under present discharge circumstances into tidal parts of coastal water or into tidal estuaries do not cause an appreciable deterioration in the quality of the receiving water, taking account in particular of the quality objectives for the environment and the permitted use of the said water.

2. The derogations referred to above may be granted for a limited period which shall expire automatically within not more than five years. Further derogations for a maximum of five years may be granted subsequently in the light of the trend in the quality of the environment, environmental consequences, the discharge effected during the previous five years and technical progress achieved in the fight against pollution in the pulp industry.

3. Before granting or extending a derogation, Member States shall forward the relevant documents to the Commission so that it can give its opinion thereon.

Article 5

Any amendments which may prove necessary in order to adapt the Annex to this Directive to technical progress shall be adopted in accordance with the procedure laid down in Article 7.

Article 6

1. A Committee for the adaptation of this Directive to technical progress (hereinafter called the "Committee") is hereby set up and shall consist of representatives of the Member States with a representative of the Commission as Chairman.

2. The Committee shall adopt its own rules of procedure.

Article 7

1. Where the procedure laid down in this Article is to be followed, matters shall be referred to the Committee by the Chairman, either on his own initiative or at the request of the representative of a Member State.

2. The representative of the Commission shall submit to the Committee a draft of the measures to be adopted. The Committee shall deliver its Opinion on such draft within a time limit to be set by the Chairman according to the urgency of the matter. Opinions shall be delivered by a majority of 41 votes, the votes of the Member States being weighted as provided in Article 148(2) of the Treaty. The Chairman shall not vote.

3. (a) The Commission shall adopt the measures envisaged where they are in accordance with the Opinion of the Committee.

(b) Where the measures envisaged are not in accordance with the Opinion of the Committee, or if no opinion is delivered, the Commission shall without delay propose to the Council the measures to be adopted.

The Council shall act by a qualified majority.

(c) If, within three months of the proposal being submitted to it, the Council has not acted, the proposed measures shall be adopted by the Commission.

Article 8

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive within two years of the date of its notification.

They shall forthwith inform the Commission thereof.

2. Member States shall ensure that the texts of the main provisions of national law which they adopt in the field governed by this Directive are communicated to the Commission.

3. Member States shall communicate regularly to the Commission their technical knowledge, as well as the experience gained and the results obtained in applying the provisions adopted pursuant to this Directive.

The Commission shall forward a summary of such information to the other Member States.

Article 9

This Directive is addressed to the Member States.

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ANNEX

REDUCTION OF POLLUTION FROM EXISTING PULP MILLS

1. A mill is defined by its type (kraft, bisulphite, semichemical, mechanical) and the size of its pulp output (in metric tons per day).

2. The primary aim of the reduction of pollution is to decrease the suspended solids (SS) and the oxidizable substances discharged, measured by their five-day biological oxygen demand (BOD), which are present in the effluents. Average daily flow, expressed in kilograms and related to the daily output in metric tons (for 90% dry material), is derived from the following table:

TABLE

	Production type	A	B	
		SS	BOD	SS
Kraft	unbleached	2,5	5	10
	bleached	10	9	20
Bisulphite	with removal or utilization of waste liquors	12.5	45	50
	without removal or utilization of waste liquors	15	80	85
Semichemical	capacity exceeding 150 t/day	5	8	5
	capacity not exceeding 150 t/day	13	60	60
Mechanical		5	5	5

3. If the reduction of oxidizable substances is carried out by treatment in aeration tanks, the upper limit for the discharge of suspended solids (SS) according to the production type, shall be that defined for Phase B

ANNEX

in the Table. If the reduction of the oxidizable substances is carried out by any other means, particularly by means of activated sludges, the values shown under Phase A must be observed.

COMMISSION
OF THE
EUROPEAN COMMUNITIES

Environment and Consumer
Protection Service

POLLUTION OF WATER BY THE PULP MANUFACTURING INDUSTRY IN THE E.E.C.

TECHNICAL REPORT

POLLUTION BY THE PULP INDUSTRY WITHIN THE E.E.C.

CONTENTS

APPENDICES

1. INTRODUCTION

This report has been prepared within the framework of the Decisions taken by the Council of Ministers on 22 Novemver 1973 on a programme of action of the European Communities on the Environment.

The pulp and paper industry - as well as certain other industrial sectors -, have drawn the attention of Council and aroused the concern of Member States because of the existence of high specific pollution loads per unit weight of final product, and the heavy consumption of water required within the production processes.

These two parameters, i.e. water intake/ton of final product, and pollution output/ton of final product, are very much higher in the pulp industry than in the paper industry. For this reason, this report concerns only pollution problems arising from pulp production, with the one exception being the problems of mills with integrated production, in which a continous process is used to produce paper directly from raw pulp.

Pollution by the paper industry will be considered in a subsequent report, which will be submitted to the Council at a later date.

It should be pointed out that the environmental aspect represents only one of the many problems facing the pulp industry of the Community, particularly with regard to its commercial position vis-à-vis its principal competitors on the world market. The other major problems are principally related to :

(i) the availability and costs of raw wood, and the desirable increase in internal forest resources, in order to reduce the dependence of the Community pulp industry on outside supply ;

(ii) the weakness of the Community pulp industry, due to its structure, which is characterized by the existence of a large number of obsolete and small mills with decreasing profit margins, in a world market dominated by large, technologically advanced mills ;

(iii) the need for new more efficient and less polluting production processes. In fact, from the technological point of view, the pulp industry is considered to have undergone little innovation : the processes which have been used for many years have been improved and made more efficient, but the basic technology has remained unchanged.

The above mentioned problems have been extensively analysed, and appropriate proposals have been made in the document ("Analytical study of the Pulp and Paper industry in the Community", SEC(74) 1215 Final, 28.3.74) which the Commission has recently submitted to Council.

The present report concerns water pollution and ways and means to reduce it. However, it must be emphasized that this specific problem cannot be entirely separated from those mentioned above, in particular from that concerning the structure of production and the size of mills. In effect, it is generally admitted that a specific reduction in pollution output can be obtained at less cost in large mills.

As mentioned above, this report is concerned with water pollution, which presents the most serious and urgent problems in the pulp sector. However, it should be pointed out that the pulp manufacturing processes also produce air pollution by the release of odorous gases and sulphur dioxide in the atmosphere, as well as pollution of the soil caused by the disposal of sludge.

2. GENERAL OUTLINE OF THE POLLUTION PROBLEM IN THE PULP INDUSTRY

In 1972, there were 213 pulp mills in the Community, including U.K., Ireland and Denmark, and these are disaggregated according to size and country of origin in Table 1.1. It can be seen that about 80 % of these have a yearly production inferior to 50 000 tons.

From the rather incomplete set of figures available, estimates made in 1972 indicate that in 1970, the discharged pollution load from the pulp industry* of the Community amounted to about 350 000 tons of BOD_5, and 95 000 tons of suspended solids.** For 1975, the corresponding figures were estimated to be 310 000 tons of BOD_5 and 57 000 tons of suspended solids. This reduction is due to additional pollution control measures and takes into account the expected increase in pulp production between 1970 and 1975.

Such relatively high pollution loads from this industry have been of major concern, and have given rise to a number of studies, by both international organizations and various state sponsored bodies.

* including integrated production

** these parameters are defined in chapter 4

One of the most detailed and recent studies was carried out by the OECD in its member countries ("Pollution by the Pulp and Paper Industry", Paris 28 June 1973) : The individual countries' data were based on their plans for 1971/72, with forecasts for 1975, and in a few instances for 1980. Although the study furnished data on pollution loads, costs, production, etc, for each major pulp producing process, no attempt was made to disaggregate the data according to the production capacities, or to indicate anti-pollution costs per % of reduction in a specific pollutant.

The relevant conclusions of this report relate to technical, regulatory and cost aspects of pollution control. It is pointed out that pollution could, in principle, be reduced to very low levels, with proper use of both internal and external technologies.

The first type of technology concerns all preventive measures designed to reduce the pollution load, which are applied to the manufacturing process in the mill itself. The latter relates to effluent treatment before discharge into the general environment.

OECD Calculations based upon the information collected show that planned pollution control programmes at existing mills in the participating countries will by 1980, reduce the 1970 load of suspended solids and BOD_5 discharged by 65 to 70 %. These figures apply to those mills existing in 1970 and their 1970 production. With the residual pollution load from new production the suspended solids and BOD_5 discharges by the industry in 1980 will be 50 to 55 % of that discharged in 1970. **

As far as new manufacturing processes are concerned, their advantage would mainly lie in reducing emissions of odorous gases, and in allowing extensive recycling of the effluent. It was considered unlikely that these could be applied on an industrial scale before 1980.

The conclusions on the regulatory aspects pointed out that a variety of anti-pollution enforcement procedures exist in OECD member countries.

In general, current legislation and regulations are applied in their entirety to new mills from the outset of production, whereas there is a period of grace which varies from one country to another to allow existing mills to conform to regulations.

** (It is interesting to note that suspended solids discharge is expected to decrease by 35 %, and BOD_5 discharge by 11 % between 1972 and 1975 within the Community, as compared with 50 % and 42 % respectively, averaged over the other OECD member countries).

The cost estimates were referred only to mills actually operating in 1970, and showed clearly that pollution control costs within the industry are likely to rise sharply in the coming years. These costs are especially high for semi-chemical and sulphite pulping, and are expected to account for 8 % of the latters' product price, in 1975.

Another study has been carried out by the Finnish EKONO Consulting Engineers, on behalf of the Food and Agriculture Organization (FAO) of the United Nations. (Submitted to FAO Advisory Committee on Pulp and Paper, 13th Session, Rome, 15-16 May 1972). This study concerned only new installations, and its purpose was to ascertain the costs of liquid effluent treatment to meet various levels of purification and their relation to laws and regulations of effluent disposal. Capital, operating and total treatment costs for six mill case situations were calculated for different percentage levels of pollution reduction.

On the national level, a study has been carried out by the Environmental Protection Agency (EPA) of the USA, on the basis of which regulations were proposed for effluent limitations and new sources standards for the pulp, paper and paper board manufacturing categories (39 FR 1908, 15.1.1974).

The National Research Council of Canada has carried out an investigation of "The Effects of Pulp and Paper Wastes on Aquatic life, with particular attention to fish and bioassay procedures for assessment of harmful effects" written by J.R. Marier, September 1973.

Finally, the Swedish Government has commissioned a time-limited development project to be carried out by the Forest Industry Research Foundation for Air and Water Protection (SSVL). Although effluent purification methods were also studied, the main emphasis was to be laid on developments inside the mills (i.e. internal measures) aimed to reduce the flow rates of and the contamination by various effluents. Attention was to be given to important sources of pollution in modern mills and to antipollution measures "economically defendable" in older mills.

Within the Member States of the Community, studies in this field are currently being undertaken by the Centre Technique de l'Industrie des Papiers, Cartons et Celluloses, at Grenoble, France, and by similar organizations in some other Member Countries. The former Institute has issued a general paper on pollution problems by the paper and pulp industry. ("Les Problèmes de l'Environnement et l'Industrie Papetière", by P. Cognard, Nov. 1973). This paper outlines the major problems from the environmental view point within the various production processes, and describes briefly certain existing or promising antipollution techniques.

3. WOOD PULP MANUFACTURING PROCESSES

Wood accounts for 95 % of the raw materials used throughout the world in the manufacture of fresh pulp. It is made up of 40-45 % cellulose, 20-30 % hemicellulose, 20-30 % lignin, while other compounds, including certain acids, constitute about 5 %. The exact composition depends on the particular type of wood.

Production techniques

The basic processes used by the industry for the manufacture of wood pulp have undergone surprisingly few modifications during this century when compared to other industries.

In general only the scale and efficiency of the processes have been improved.

As mentioned before, during the production of paper from wood, roughly 90 % of the pollution load arises during the pulping, or in particular the "pasting" process, which is basically designed to separate the fibres in wood by mechanical or chemical or combined means. The process types can conveniently be split up into the following : mechanical, two types of semi-chemical and chemical. The latter can be further subdivided into the sulphate (Kraft) process, and the sulphite process.

3.1. Mechanical pulp

The technique consists of rasping or scratching the wood on a millstone in the presence of water. The fibres are torn away from their natural environment, are often cut, and the lignin is separated.

This is a relatively simple process, with a useful conversion rate of more than 95%. Since no chemicals are used, the resulting pollution is caused partly by certain non-toxic constituents of the wood which are soluble in warm water, but mainly by fibres or fragments of fibres which have escaped from the process.

However, the pulp produced in this way is not very strong mechanically, and is fairly coarse. Its use is thus mainly limited to the production of newsprint.

3.2. Semi-chemical pulp

A variety of processes fall under this heading. The basic method is to pretreat the wood chemically, thus facilitating the mechanical treatment, so that the integrity of the fibres can be better preserved.

The relative weakness of the chemical action as compared to other processes, (to be described next) enables more of the lignin and hemi-cellulose to be retained in the pulp. Hence, the wood to pulp conversion is very favourable, varying between 60 % and 85 %, and therefore the product is sometimes called high yield pulp.

The mechanical properties of the fibres in this case are better than those obtained by the purely mechanical process described above. It is considered that recovery of waste is not economically practicable for mills using this process, which produce less than about 100 tons/day (i.e. about 33 000 t.p.a.).

3.3. Chemical processes

All major processes other than the above, involve chemical treatment in addition to the initial physical preparation. The underlying sequence is common to all chemical processes ; before being pulped, the logs are debarked, chipped and so that they will become impregnited with the chemicals.

The shavings are then cooked in a pressure vessel in which the chemical cooking solution fills the void spaces in and around the fibres, which are thus separated and the lignin dissolved. Any subsequent bleaching will eliminate most of the remaining lignin, leaving only cellulose and hemi-cellulose.

3.3.1. Sulphate pulp (Kraft)

This is the process most commonly used. The cooking agent is a mixture of soda and sulphide. The sulphide speeds up the rate of delignification, and thus limits the degradation of the fibres.

The resulting liquors are charged with carbonate and sulphur derivatives of sodium as well as organic Substances originating from the alkaline degradation of the lignin. A substantial part of these liquors can be recovered by concentration and burning, which results in some recovery of calories, regeneration of certain raw materials, and diminution in pollution load.

The yield, at 40-55 %, is somewhat lower than in the sulphite process (to be described next). However, because this process depends on recovering heat and chemicals for its economic feasibility, the amount of pulping wastes discharged into the water is relatively low, sometimes 1/20 of that from calcium sulphite pulping. On the other hand, the air pollution is relatively high.

Kraft pulp has extremely good mechanical properties.

3.3.2. Sulphite pulp

The cooking of wood is carried out in an acidic environment (pH between 2 and 5). The traditional cooking base is calcium, and only fairly recently have other bases such as magnesium, sodium and ammonium come into wider use. Only when the soluble bases sodium or magnesium are used is the recovery of the liquors technically and economically feasible. With ammonium, the liquors can be destroyed but not recovered.

During this process the lignin is dissolved, and lignosulfonic acid is formed. The subsequent hydrolysis and oxidation of the acid and hydrocarbons liberates certain byproducts such as sugars, acids, and aldehydes.

The pulp produced by this method is clearer and easier to bleach than kraft pulp, but its mechanical properties are not as good as those of the latter.

3.4. Manufacture of paper and board directly from raw wood

Many manufacturing installations integrate the production of pulp with the production of paper in a continuous process. After mechanical or chemical pulping, the aqueous suspension of cellulose fibres is transformed to paper or cardboard by operations designed to improve the cohesion of the fibres and to eliminate the excess water from the suspension.

While the pollution problems associated with the transformation of pulp to paper and board are known, in broad terms there is insufficient data available on antipollution techniques and their costs, specific to this sector. Therefore, the integrated process is not considered in detail in this report. However, according to latest estimates, the Community production of pulp by the integrated process accounts for about 10 % of the total pulp production.

3.5. Pulp produced from other raw materials

About 5 % of fresh pulp produced throughout the world is made from raw materials other than wood, principally straw, flax and bagass. Owing to their minor importance within the global pulp production, the pollution resulting from manufacturing processes using these raw materials has not been considered in this report. However, it should be stressed that their importance, particularly in view of the current and future raw material supply situation, should not be disregarded. As far as their pollution impact is concerned, a report has been published by ASSOCARTA, the Italian Association of Pulp and Paper Producers. In general, the pollution discharge from a straw pulp mill is comparable to that from a chemical woodpulp mill of a similar size.

Recycled paper also consitutes a major source of raw material supply. For instance, in the United Kingdom, over 40 % of the total pulp production is by utilization of waste paper. The development of this sector should be encouraged with a view to increasing the Community's own raw material resources (see SEC(74)1215 Final 28.3.74). The major source of pollution during the recycling process is the deinking stage. A study is presently being carried out in this field by the services of the Commission and the results will be available by the end of 1974.

4. NATURE OF POLLUTION

The pollutants discharged by the paper and pulp industry have the following characteristics : they consume the oxygen in the water, float as suspended (but not dissolved) solids, foam and/or colour the water, and are sometimes toxic. The discharged pollutants are normally measured in terms of 5 day biochemical oxygen demand (BOD_5), suspended solids (SS), and sometimes toxicity, foam, colour and pH are also monitored.

It is generally felt that these parameters characterize adequately the pollution discharge from pulp mills. In some cases, more appropriate parameters may exist, but these usually require difficult or expensive testing, and adequate basic data are often not available.

4.1. Biochemical oxygen demand

Fish and other aquatic life are dependent on the dissolved oxygen content of the water. Pulp mill wastes use up oxygen as they decompose thus depleting the oxygen content of the receiving water body and hence imposing stresses on all aquatic organisms. The most commonly used indicator of the oxygen demand of the liquid effluents is the 5 day Biochemical Oxygen Demand (BOD_5) expressed in mg/l or Kg/ton of final product. However, another parameter is the Chemical Oxygen Demand (COD) which is sometimes used in its place or simultaneously. In some countries (e.g. France) the oxygen demand parameter used contains measures of both chemical and biological oxygen demand.

4.2. Suspended solids

Pulp mill wastes tend to contain appreciable quantities of suspended wood fibre. These can eventually blanket the bottom of the waterway, resulting in suffocation of bottom-dwelling life and also favouring the formation and release of hydrogen sulphide. In addition, the possibility of detrimental slime growth is thereby greatly increased. Suspended solids are expressed - as the BOD - in mg/l or Kg/ton of final product.

4.3. Toxicity

Pulp wastes contain several substances that are directly poisonous to sensitive aquatic organisms : Factors contributing to toxicity are not only chemicals which are added during the manufacturing process - (principally sulphur compounds) - but also dissolved organic complexes of the wood.

It should be pointed out that biological toxicity tests on mill effluents are increasingly being used throughout the world. These tests are performed on aquatic organisms themselves, and allow fast control of any toxic substances which may be present in excessive quantities.

In certain EEC Member states, a universal toxicity test is coming into use. This is a simple biological test, which gives an estimation of the effluent's impact on a specific fish : e.g. shrimp. Other animals or organisms are also sometimes used.

The test is universal in the sense that it indicates the total toxicity of the pollutants in the effluent . The unit of measure used in France is the equitox, where effluent containing 1 equitox per cubic metre kills 50 % of shrimps in the sample.

4.4. Foam and colour

Effluent colour stems mainly from the lignins of the wood. The foaming is due to chemicals used during the manufacturing processes. The dark colouring in some pulp and paper wastes reduces the penetration of sunlight into the water which affects the photosynthetic processes beneath the surface. The foam-apart from being unaesthetic, - has similar effects to the colour.

4.5. Pollution discharge levels

It is instructive to examine the pollution loads from the different pulp producing processes. The figures shown below are mean pollution fluxes for mills with standard 1970 technology, not taking into account the effects of any external measures. These values are intended as a guide, for purposes of comparison. The actual pollution load can vary substantially from one mill to another.

Mean Pollution Levels

Process	Suspended solids	BOD_5
	Kg/ton	Kg/ton
Mechanical pulp	30	10
Semi-chemical pulp		
• without recovery of cooking liquor	50	290
• with recovery of cooking liquor	40	90
Sulphite pulp		
• without recovery of cooking liquor	60	450
• with recovery of cooking liquor	50	250
Raw Kraft		
• without recovery of cooking liquor	20	240
• with recovery of cooking liquor	10	40
Bleached Kraft		
• without recovery of cooking liquor	50	290
• with recovery of cooking liquor	40	90

4.6. General summary of chapter 4

1) The nature of pollution arising from pulp mills is well known.

2) The effluent is adequately characterized by the parameters generally used, i.e. BOD_5, suspended solids, pH, colour, toxicity.

3) Toxicity measurements in general, and universal toxicity in particular, are coming into wider use. While these tests may be better correlated with the overall harmfulness of the pollutants, at present, they are more costly and difficult to carry out.

4) The characteristics of the receiving water have a major influence on the final effects of the pollutants discharged.

5) The long term pollution load, deriving from the lignin compounds, is also of great importance. This is very difficult to measure, but it is known that biological purification does not reduce the lignin discharge.

5. LEGISLATION, STANDARDS AND GUIDELINES RELATED TO ENVIRONMENTAL PROTECTION FOR THE PULP INDUSTRY

1. Introduction

In all the member countries of the Community, there is a basic framework of legislation in the field of environmental protection. In general, such legislation is either recent, or in the process of being modified, as knowledge and awareness concerning the environment grows.

To date, few member countries have drawn up legislation specifically applicable to pulp mill effluent discharge into water.

France is the only member country to have established uniform target standards for effluents from pulp mills. This was done in the context of an agreement, namely "Contrat de Branche", of June 1972, between the French Ministry of Protection of Nature and Environment - (now the Ministry of Quality of Life), - and the French Confederation of Paper, Board and Cellulose Industries (COPACEL). This agreement was drawn up to reduce pollution from chemical and semi-chemical pulp mills, and those mills which are signatories - in fact nearly accounting for the total pulp industry - have committed themselves to comply with a programme of reduction in the pollution levels of their effluents. In order to support this programme, the French Government and the Water Catchment Financial Board (Agence Financière de Bassin) are providing financial aid. The French Government is incorporating certain features of this agreement into formal legislation.

Belgium has laid down legislation (1) concerning effluent discharges for industry, including specifically the paper and pulp industry. Acceptable discharge levels were established in this context for industry, and mills whose discharges exceed the appropriate levels have to pay charges to the regional water boards. Installations which discharge into public drains similarly have to pay charges. The acceptable pollution discharge levels vary according to the particular water course, public drain etc...

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(1) "Loi sur la protection des eaux de surface contre la pollution" March 26, 1971.

The Federal Government of Germany has introduced draft legislation (29.3.1974) concerning taxes to be applied on the discharge of effluent. In principle, the charge depends on the number of units of "noxiousness" which the discharged effluent contains. The factors which make up this parameter are suspended solids , chemical oxygen demand content and toxic effects of the effluent.

Most of the other member countries use "guidelines", either to establish a range of permissible discharge levels, or to propose a maximum permissible set of pollutant discharges. The actual discharge level permitted is usually negotiated and decided individually for each mill, in the light of criteria applied to the assimilative capacity of the receiving waters.

Within the framework of existing legislation or practice a number of non-member countries, including major pulp producers such as Canada, U.S.A., Japan and the Scandinavian countries, have either established or are proposing to establish regulatory discharge standards specifically for this industry.

It is generally accepted that new mills must comply immediately with any relevant environmental legislation, whereas existing installations are usually given a "period of grace" in which to carry out any necessary modifications.

A summary of the various forms of environmental legislation, etc, existing in member countries is presented in Table 5.1. Table 5.2. - drawn up for information - is a summary of legislation in OECD Member states, and is taken from the OECD report referred to previously.

5.2. Approach to the establishment of permitted discharge levels

In countries where regulatory standards, guidelines or treatment programmes exist, or are being worked out, the approach most commonly used is to base these on the levels that can be achieved by the application of the best control technology currently available, and economically practicable. The other criteria which are often taken into consideration as well concern the assimilative capacity (1) of the receiving water, and toxicological effects. Interpretation of these criteria, in particular of economic practicability, varies strongly, often according to the social, economic and financial interest of the country concerned.

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(1) The assimilative capacity is considered to be the capacity of the receiving water to absorb and dilute the pollutants, without undergoing an appreciable deterioration in its quality further downstream.

5.2.1. Best control technology approach

One definition has been formulated by the Environmental Protection Agency (EPA) of the U.S.A. According to this, for each production category, the "best practicable control technology currently available" (BPCTCA) is based on an average of the best existing performance by plants of various sizes, ages, and unit processes, within each category. It is proposed by the EPA that all existing mills in the U.S.A. should comply with these BPCTCA levels by 1977. The other major criterion concerning pollution abatement levels is the "best available technology economically achievable" (BATEA), which is established either by identifying the best control and treatment technology employed within a specific pulp production category, and/or by applying technology from other industrial sectors, where it is transferable. The EPA is proposing that BATEA levels should be achieved in the U.S.A. by 1983. New source performance standards were developed using BPCTCA levels as a guide, and adding control improvements possible by production processes designed to reduce pollutant loads, particularly with reference to recovery, reuse, and spills.

However, none of the above critera requires any major change in the existing pulp manufacturing process.

Other philosophies concerning best practicable means also exist. For example, this concept can sometimes be related to an individual firm or installation, by taking into account its location, profitability etc...

5.2.2. Assimilative capacity approach

In EEC member countries, the assimilative capacity of the receiving water is considered with special attention. In this context, the French "Contrat de Branche" classifies pulp mills into three geographical priority areas, and determines for each a different timetable by which the prefixed uniform discharge levels should be attained.

Toxicological criteria are used by Canada, whose fishing industry is of considerable importance : the maximum BOD_5 and suspended solids discharge levels are defined federally on the basis of best practicable technology. However, mills must also locally comply with a standard toxicity requirement for fish, and this may involve a local decrease in the maximum permissible BOD_5 and suspended solids discharge.

5.2.3. Enforcement

In member countries, violators of the relevant environmental legislation are liable to various kinds of penalties, including fines, inprisonment or shutdown of production. However, a strict application of these penalties is seldom reported. The Commission is considering in what ways the application of Community legislation in general can be improved. Furthermore, a programme of action for compliance with the limits established for the protection of the environment in particular is being worked out by the Commission (see SEC(74)70014, 30 January 1974, Title I, chapter 8).

5.3. Norms and standards for effluent discharge

5.3.1. Units of measure

The two basic means of expressing pollution in the discharged effluent are :

(i) the pollution load, expressed in Kg of pollutant per ton of pulp e.g. Kg BOD_5/ton of pulp ;

(ii) the pollutant concentration, expressed in mg. of pollutant per litre of effluent discharged e.g. mg. BOD_5/litre of discharged water.

The latter parameter is more practicable to measure and to survey by the authorities, but it could encourage polluters to increase their water consumption, in order to reduce the concentration of pollutants to the permitted levels. For this reason, whenever norms are expressed in terms of pollutant concentration (mg/l), strict control on the consumption of water per unit weight of pulp produced should be practised. When this is done, parameters (i) and (ii) are, in fact interconvertible.

5.3.2. Comparison of discharge limitations

As pointed out in section 5.1., France is the only member country to have established uniform effluent standards, in the context of the Contrat de Branche, and more recently in the form of legislation, for the Kraft, sulphite and semi-chemical pulp production categories. As can be seen from Table 5.2., by 1972, a number of non member ocuntries had also proposed or laid down pollution discharge limits.

It is, of course, not strictly valid to compare the existing or proposed standards or guidelines of the various countries, due to differences in the size, structure, and relative importance of the industries, as well as the degree of financial aid they receive. However, in spite of these differences figs 5.1 A to 5.1 E - drawn up mainly on the basis of the OECD report - show. that there was some agreement between the standards within each production category. This implies that there was corresponding agreement over technical possibilities and desirable goals in the anti-pollution field.

It should be pointed out that since the publication of the OECD report, a number of non-member countries, most notably the U.S.A., Canada and Sweden, have increased the stringency of their standards.

6. FINANCIAL AIDS

Permitted effluent discharge levels are not only decided upon the basis of technological possibilities, but also take into account the net investment cost of the required anti-pollution technology. In most member countries, as well as in non-member states, existing industry does not support the entire investment cost of the necessary anti-pollution equipment. Agencies or other bodies, at national or regional level, contribute, often substantially, towards the financing of pollution control equipment and installations. It should however be pointed out that such financial contribution is usually limited to existing mills and their actual production capacity, and is allowed for a limited period of time. Generally, running costs are not covered by such supports.

There are three major types of public support for pollution control measures :

(i) direct subsidies or grants for pollution control investments ;

(ii) tax reliefs, often in the form of accelerated write - off for pollution control facilities ;

(iii) loans from public funds, usually with preferential rates of interest.

Other types of aids, both social and regional, may also provide indirect support towards the financing of pollution control equipment.

While the definition of what is pollution control equipment is relatively straightforward for the case of external measures, it may present some problems for internal measures, which can often increase the production efficiency, as well as reducing pollution.

The Commission has drawn up a series of tables 6.1 A and B (given in the Annex) showing the availability and framework of financial aids in member countries, on the basis of information furnished by the national experts.

Owing to the fairly general nature of this information and the different accounting systems and terminology used by the Member states, it was not possible to work out and compare the percentage of the total pollution control costs which have to be borne by the industry within the various member countries.

Of the member countries, France, United Kingdom, and more recently Belgium offer the possibility of granting subsidies to industry, including the paper and pulp industry, for pollution control investment costs.

As can be seen from Table 6.1.B, for France, the aids available directly from the Government are up to 10% of the investment, and refer to water pollution abatement in existing semi-chemical and chemical plants.
Other subsidies originating, inter alia, from charges levied by the Agences de Bassin are added to this.

The U.K. provides between 20 and 22 % of the capital costs for all types of industrial investments, within designated development regions.

Subsidies for existing industrial installations in Belgium are given within the framework of the "Arrêté Royal" of 23 January 1974. According to this legislation, 60 - 30 % of the investment costs, depending on the date of the request (1974 - 1979), are provided by the Government, to enable the installations to arrive at the most efficient and economical pollution reducing systems.

A completely different situation however exists in some non-member countries and notably in Sweden. This country allows substantial financial support to facilitate the implementation of new technologies in existing mills in order to comply with rather stringent environmental standards. During the past year subventions up to 75 % of total investment costs have been given.

7. POLLUTION CONTROL TECHNOLOGY

7.1. Introduction

The major environmental problem arising from the manufacture of wood pulp is water pollution. This results from very high specific water consumption, and the large quantities of dissolved organic substances and suspended solids in the effluent. The most urgent pollution problems concern the chemical pulping processes.

As mentioned before, internal pollution controls are situated within the manufacturing process, whereas external measures refer to on-site effluent treatment installations, which usually operate on the final effluent from the process.

It should be pointed out that the figures for the possible reduction of pollution load by the various techniques outlined in the following sections (8.2 and 8.3) are mainly taken from reports :

1. OECD "Expert Report on Advanced Pollution Abatement Technology". Addendum IV to "Pollution by the Pulp Industry", Paris, 1973
2. "Study of Pulp and Paper Industry's Effluent Treatment", prepared for the FAO by EKONO Consulting Engineers
3. "Development trends within the pulp industry" by L. Bruneau, IVL, Stockholm
4. "Development Document for Proposed Effluent Limitation Guidelines, and New Performance Standards for the Unbleached Kraft and Semi-chemical Pulp segment of the Pulp, Paper and Paperboard Mills Point Source Category" U.S. Environmental Protection Agency, January 1974
5. Data provided by experts engaged by the Commission of the European Communities.

7.2. Internal measures

These measures are designed to reduce the causes of pollution at their origin, and often result in the recovery of chemicals and by-products as well as conservation of heat and water.

Fig. 7.1 shows, schematically, the basic chemical process for the manufacture of pulp, and the main sources of pollution therefrom.

The most important internal measures utilizable at each stage of the process are outlined below, and for each of them reference is made to Fig. 7.1.

7.2.1. Wet barking

Wet barking always causes water pollution of some degree, usually above 2 kg of BOD_5/ton and about 15 Kg of suspended solids/ton of pulp, as well as a considerable amount of lignin release.

There are two basic possibilities to reduce pollution from this operation :

(i) Dry barking, which can eliminate pollution from this stage almost completely. The bark can be reused in the manufacture of fertilizers. The operating cost of the required equipment can be offset by the increased useful yield and fuel value of the bark.

(ii) Recycling of barking effluent.

In some cases, where the pulp mills receive wood in the form of chips, either direct from the forest, or - more usually - from the saw mills, no barking is required at the mill. In this case however the problem of the bark still remains in the forest or at the saw mill where the wood is debarked.

7.2.2. Washing and screening

Washing and screening losses can presently be as high as 20-30 kg BOD_5/ton for Kraft pulp, and 30-40 Kg BOD_5/ton of sulphite pulp (assuming an 85 % recovery rate). Such losses can be reduced to 4 and 10 Kg of BOD_5/ton of pulp, respectively, by improved washing, utilising washing filters, continuousdiffusers and "hi-heat" washing.

In those plants which practise recovery of the cooking liquor, the washing operation has a particularly strong effect on the final level of pollution discharge.

The compounds dissolved in the water leaving the wash take one of three "paths". They are :

(1) Partly introduced and dissolved in the washed pulp ; (fraction dissolved in the pulp defines the quality and efficiency of the wash).

(2) dissolved in the effluent rejected during or after washing

(3) dissolved in the recovered liquor, which is burnt after concentration.

Hot screening and closed screening systems can be used to reduce the volume of the effluent. The former technique is designed to remove the knots and

shives in the pulp, thus avoiding the need for dilution of the pulp for screening, subsequent to washing. Closed screening involves the use of a closed circulation system. The adoption of the above techniques will typically reduce the BOD_5 discharge by 6 Kg/ton, and the suspended solid load by about 50 %.

7.2.3. Spent liquor treatment

This refers to treatment of condensates originating from the digestion of the pulp and the evaporation of spent liquor The untreated evaporation condensate for sulphite mills, using calcium derivatives, would contain a BOD_5 load of 25-30 Kg/ton of softwood pulp, and possibly up to 50 Kg of BOD_5/ton of hardwood pulp. The corresponding pollution load from this stage in a Kraft mill would be 10-15 Kg of BOD_5/ton of pulp.

For the case of Kraft mills, the re-useof condensate coupled with treatment in a stripping column has lowered the BOD_5 to 2-3 Kg/ton of pulp.

For sulphite mills, a major step in pollution reduction was made with the practice of evaporating the cooking liquor Unfortunately, the evaporation itself yields a condensate which is acidic, and has a high specific BOD_5 content. In some cases, neutralization of the liquor. before evaporation is possible, and recirculation of part of the condensates to the process has thus become practicable. Neutralization, when possible, lowers the BOD_5 output from this stage by 50 %, and adsorption of acetic acid on an ion exchanger, plus stripping of methanol and other organics, by a further 20 %. It is thus possible to reduce the BOD_5 of the condensates to 5-6 Kg/ton for softwood pulp, and 10-12 Kg/ton for hardwood pulp.

7.2.4. Bleaching

In a modern Kraft pulp mill, the bleaching effluents constitute a major fraction of the total pollution. The darkening of the effluent by lignin, is of particular concern. Due to their high chloride content, the bleach plant effluents cannot be returned to the black liquor for burning, as this would cause too much corrosion and they are therefore usually discharged.

Oxygen bleaching is a delignification treatment which can be imposed between the washing of the raw pulp and the classical bleaching operation : part of the lignin is thereby dissolved, and the liquor including 50 to 70 % of the total bleaching pollution load can be recycled. Thus the operating cost of this process is offset by the resulting savings in chemicals.

Unfortunately, not all the chlorine demand can be replaced by oxygen. The fraction which can be replaced depends on the bleaching quality required with about 50 % of the classical chlorine demand still necessary for the attainment of fully bleached qualities of pulp. The reduction of pollution from oxygen bleaching amounts to 6-8 Kg of BOD_5/ton of pulp.

The ion exchange technique can contribute further to the reduction of BOD_5 and lignin in the waste water. This technique aims to extract the chloride ions from the bleaching effluent, in order to allow its evaporation and combustion. This technique can reduce lignin discharge due to bleaching by 75 %, and BOD_5 load by 50 %, thus also reducing the colour.

The organic content of the bleaching effluent can also be decreased by using counter-current washing, which, by reducing the volume of bleach effluent, allows its evaporation by burning.

7.2.5. Accidental discharges

As continuous effluent discharges are progressively reduced, the percentage of pollution discharge accounted for by accidental releases increases.

In a modern mill, emergency tanks are available to recover any leakages. However, the best way of preventing the occurrence of undue accidental discharges is by the operation of increasingly reliable process equipment. Furthermore, large and modern mills now have the opportunity to install computerized process control, into which alarm systems for accidental discharges can be built. In this way, such discharges can be reduced to average 1 Kg of BOD_5/ton of pulp.

7.2.6. Summary of possibilities with existing or developing internal measures.

It is considered that with proper use of the relevant internal measures mentioned above, the BOD_5 discharge in a bleached Kraft mill can be reduced to about 13 Kg/ton of pulp, 7 Kg/ton of pulp from an unbleached Kraft mill, and 27 Kg/ton of pulp from the sulphite process.

7.3. External measures

External measures consist of the treatment of effluents which are discharged during and after the manufacture of pulp. Internal measures - as outlined in the previous section (7.2)-can substantially reduce the level of pollution by modifying the manufacturing process. However, in most cases, effluent treatment is still required to reduce the final pollution load to an acceptable level.

The existing processes and techniques designed to reduce the discharged suspended solids and organic wastes are likely to remain in use for some time ; improvements and modifications, particularly in process control and effluent monitoring, however, can be expected.

In general proper external treatment comprises of, at least, two or three stages : the primary treatment to reduce suspended solids, the secondary and tertiary which reduce the BOD_5 content, and possibly some additional treatments, aimed at reducing colour.

7.3.1. Removal of suspended solids

In order to avoid damaging the succeeding equipment, some pretreatment, particularly of barking and washing effluent is normally employed.

Primary treatment itself consists of removing suspended materials, both organic and inorganic, by a physical process. This is accomplished by sedimentation, using mechanical clarifiers or sedimentation lagoons, and/or by flotation techniques.

7.3.1.1. Sedimentation lagoon

These lagoons were widely used in the past, but the large land requirement, relatively inefficient performance and high cleaning costs have recently made this technique less popular.

7.3.1.2. Dissolved air flotation

Dissolved air flotation technique has been particularly employed for the treatment of effluents from paperboard mills using waste - paper as raw material, and has achieved up to 98 % removal of suspended solids. However, this type of equipment is at present expensive to install and operate, and is therefore seldom used. It is pointed out that the economics of this process is rapidly changing, particularly where space requirements are at a premium.

7.3.1.3. Mechanical clarifiers

This is probably the most widely used primary treatment method. The equipment basically consists of large circular tanks, with sludge scraping mechanisms mounted in the centre. The settled sludge is raked to a sump or hopper, and is conveyed for further concentration or disposal by solids handling pumps. Floating material is collected by surface skimmer, and then discharged to a hopper.

This technique can achieve suspended solids removal in excess of 75 - 80 %.

7.3.2. Removal of BOD_5 content

The BOD removal is generally accomplished by biological means due to the relatively high biodegradability of the organic substances in the pulp mill effluent, with the notable exception of the lignin content.

Analysis of the available data from the OECD report (see table 7.1) shows that by far the greatest effort both within and outside the EEC, is directed towards increasing the number of secondary (BOD_5 removing) treatment installations.

Table 7.1. : Number of external treatment installations for pulp and paper mills

	Primary			Secondary		
	1970	1975 (forecast)	% increase	1970	1975 (forecast)	% increase
E.E.C. (1)	425	577	36	41	143	273
Non Member states (2)	362	434	20	273	646	137

The three main treatment techniques used for BOD removal are as follows :

(1) Excluding Denmark and Ireland

(2) Non Member states : Austria, Canada, Finland, Norway, Sweden, U.S.A.

7.3.2.1. Activated sludge

In this process, after attack of the waste by biological organisms, a sludge is formed, within the relatively fast retention time of 3 - 7 hours. A large quantity of sludge is generated by this technique, and only part of it can be recycled back to the process, or used as a biological fertilizer.

The activated sludge method involves intimate contact of the waste with biological organisms, followed by sedimentation. A high degree of BOD_5 removal is obtained. (95 %)

7.3.2.2. Natural lagoon

This treatment is based on natural biological activity (oxidation). which has a fairly low rate, with retention time being of the order of months. It is therefore used in locations where land is freely available, and/or where the process rate is enhanced by a warm climate.

7.3.2.3. Aerated lagoon

The ability to assimilate BOD_5 per unit surface area of a basin is considerably enhanced by the installation of artificial aeration equipment. Under optimal conditions in aerated lagoons a retention time of 5 to 7 days is sufficient to achieve an 85 % reduction in BOD_5.

The BOD removal can be increased by employing two or more treatment plants in series.

7.3.3. Sludge treatment and disposal

One of the major problems connected with external treatments, particularly biological or chemical, is sludge disposal, which in some cases limits the use of above methods for effluent treatment . The cost of biological treatment varies naturally according to the degree of BOD_5 removal, but is also strongly dependent on the sludge disposal method used.

7.3.4. Effluent decolouration

As pointed out in chapter 4, effluent colour is not only aesthetically displeasing but it interferes with aquatic organisms by retarding the transmission of sunlight through the water. This therefore represents a major problem, particularly for Kraft mill effluents.

Biological treatments have little effect on the effluent colour, because the lignin derivatives mainly responsible are not very biodegradable. However, since colour is also an indirect indication of the presence of dissolved organic compounds, its efficient removal, by a more sophisticated method, may, in the future, obviate the need for biological treatment to reduce BOD_5.

Most of the research and development in this field has been concentrated on the development of lime precipitation techniques, because of their favourable economics, and the experience acquired in Kraft mills. Colour removal efficiencies in the 85 - 90 % range are being achieved, but large volumes of sludge are being generated. Work is proceeding to recover and dewater lime sludge, and to incinerate it subsequently in the lime kiln.

Other possible colour removal techniques are currently receiving attention, specifically the activated carbon and reverse osmosis processes which have not yet been widely used on the industrial scale.

8. THE ECONOMICS OF POLLUTION CONTROL

8.1. Introduction

In this chapter, estimates of the costs of achieving certain levels of pollution abatement in the pulp industry are proposed.

For this purpose the Commission originally intended to obtain detailed data and information from each member country. The information requested concerned the present and planned pollution abatement to be achieved, taking into account the various production categories, and the distribution of production capacities.

Two sets of questionnaires were prepared and sent out to the Member States for this purpose. However, the replies received were generally inadequate, apparently for reasons of secrecy, lack of data, or reluctance to furnish such information.

For this reason the analysis performed in this chapter is, of necessity, based only on the elaboration of existing information and data sources as listed in Section 7.1 of this document.

8.2. Economic terminology

Pollution control measures are defined as measures beyond those normally required for economical operation of the mill, and motivated by the objective of reducing polluting effluents and emissions (definition adopted by OECD).

The following economic terminology, based on the EPA development report, has been adopted :

Investment costs are defined as the capital expenditures required to bring the treatment or control technology into operation. These include the traditional expenditures such as design, purchase of land and all mechanical and electrical equipment, instrumentation, site preparation, plant sewers, all construction work, installation and testing, etc.

The capital costs are the financial charges on the capital expenditures for pollution control.

The depreciation is the accounting charges which reflect the deterioration of a capital asset over its useful life.

Operation and maintenance costs are those costs required to operate and maintain the pollution abatement equipment. They include labour, parts, chemicals, energy, insurance, taxes, solid waste disposal, quality control, monitoring and administration, etc. Any productivity increases or by-product revenues as a result of improved effluent control should be subtracted so that the operation and maintenance costs arrived at are the net costs.

8.3. General problems in determining the costs of pollution control

The concepts of "pollution control costs", and their analyses are currently being studied by the Commission as well as by a number of Centres in the Community. Detailed discussion of this topic is outside the scope of this document. However, it is pointed out that at a recent Conference on Waste Water Treatment (1) it was stated that in general "pollution control cost data available at present are incomplete, and of very variable quality. Great care is needed in their interpretation and only extremely tentative conclusions can be drawn from them".

8.4. Discussion of the relevant sources of data and their utilization

8.4.1. Sources of data

(i) The OECD report on "Pollution by the Paper and Pulp Industry" (Paris, 1973) : In this report there are two basic sets of cost data :

1) The tables containing the data for each OECD member country and which relate to pollution control costs in 1970, and the projected costs for 1975 and 1980 where available. The costs are given in U.S. dollars per ton of pulp production. They are split up into internal and external costs for water pollution, and presented as a total for air pollution.

2) The second set of data is much more detailed, but concerns only the cost estimates for specific internal and external pollution control measures in a hypothetical, existing mill, producing 500 tons of bleached sulphate pulp per day from softwood. This study was part of the OECD Expert Report on "Advanced Pollution Abatement Technology" in this industry.

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(1) "Industrial Waste Water Treatment and Disposal within the EEC" ; Amsterdam 6 - 8 May 1974

(ii) The EKONO report for the FAO : As mentioned in chapter 2, this study concerned only hypothetical new production installations, and part of its purpose was to ascertain the costs of liquid effluent treatment to meet various levels of purification. Capital, operating and total treatment costs for six mill case situations were calculated for different levels of pollution reduction. The cost of certain internal measures was also considered.

(iii) EPA Guidelines Development Document : In this report, the costs of attaining BPCTCA, BATEA and new source performance standards, as described in chapter 6, were calculated for a specific mill size in each production category.

3.4.2. Utilization of data

One aim of the analysis attempted here is to establish whether there exists any consensus between the various data sources concerning the costs to achieve a specific pollution discharge level within a particular production category.

Table 8.1 summarizes the necessary background to the cost estimates in the three main sources of data utilized here :

TABLE 8.1. COMPARISON OF AVAILABLE DATA SOURCES

Report	Relevant pulp production categories considered	Mill size	Based on prices in	Annual charge as % of investment cost (2)	Assumed pollution discharge level before any anti-pollution measures		Data considers			Pollution control costs for reduction of		
					BOD Kg/ton	SS Kg/ton	New mills only	Existing mills only	Both mill types	BOD_5	SS	Both (BOD_5+SS)
OECD	Semichemical Sulphite (non integrated) sulph. Integrated sulphate) pulp and paper newsprint from groundwood	No size distinction	1970	16				/ / / / /				/ / / / /
OECD (advanced Tech)	Bleached sulphate	500 tpd (1)	1970	16	45	33.3		/				/
EKONO	Bleached sulphate Bleached sulphate Unbleached sulphate and sack paper Newsprint from groundwood	300 tpd 750 " 750 " 350 "	Dec. 1971	15	40 40 25 20	25 25 30 17	/ / /			/ / /		
CPA	Unbleached sulphate *NSSC - sodium base NSSC - ammonia base	1000 tpd 250 " 250 "	Aug. 1971	not stated	25 175 -	35 37.5 -			/ / /			/ / /

* NSSC : neutral sulphite semi-chemical

(1) t.p.d. : number of tons of pulp manufactured per day

(2) Annual charge is made up of depreciation on capital expenditure and interest on capital

It can be seen from the above table that strict comparison of the data from the different sources is not possible. Therefore certain assumptions and simplifications are made, and explained below.

(1) Pollution index

In all the cost data available, it is impossible to distinguish the amount devoted to a specific reduction in BOD_5 discharge only, and that used to achieve a reduction in suspended solids discharge only. This is, of course, partly due to the fact that many techniques achieve reductions in both types of parameters, although the relative amount of reduction is usually greater for one of them than for the other.

Therefore, a composite index of pollution has had to be adopted, and that used by the OECD was adhered to. This "Pollution Level Index" is expressed as 2 BOD_5 Kg/ton + S.S. Kg/ton. As the OECD report points out, such a selection is rather arbitrary, but has little effect on the form of the pollution level VS cost curve. However, care must be taken in using this curve because several combinations of BOD_5 and suspended solid levels could give the same pollution index.

(2) Production categories and mill sizes

The production categories adopted in this document are basically equivalent to the classification used in the OECD report, except that data concerning the paper making stage has not been considered.

This makes direct comparison with the EKONÓ data very difficult, because the latter considers integrated mills in four out of the six case studies. These types of mills are clearly more appropriate for new production installations.

The EPA document does not consider the mechanical and bleached sulphate production categories. Furthermore, it subdivides the semi-chemical category into installations using ammonia-based cooking liquors, and those using sodium based liquors. Such a classification is appropriate to the structure of the industry in the U.S.A. but does not reflect the situation in the Community.

The mill sizes considered in the various case studies are also different, but although this makes direct cost comparisons hazardous, it does provide some idea of the variation of pollution control costs with mill size.

However, most of the case studies consider mills which have more modern process equipment as well as production capacities well above the appropriate averages within the EEC, for each of the categories considered. Hence, from this aspect, the cost levels indicated are likely to underestimate the true total cost of pollution control for many pulp mills within the Community.

(3) Economic data

The OECD have assumed a 10 year depreciation write-off period for anti-pollution installations, and an annual interest rate on capital of 9 %. In effect this results in an annual charge of about 16 % of the investment. The 10 year depreciation period probably underestimates the life-time of anti-pollution equipment in general.

EKONO use an annual charge rate of 15 %.

As can be seen from Table 8.1, the price and cost estimates for all data sources are based on 1970/71 prices. Thus, although they are comparable in the appropriate cases, they underestimate present and probably future costs, due to inflationary factors.

It should also be noted that the OECD and the relevant EPA estimates concern the installation and operation of equipment relative to an existing mill, whereas EKONO considers only new mills.

Finally, mention should be made of the difficulty of determining investment and operating costs accurately. The former depends to a large extent on such factors as the price of land, construction, etc (see section 8.2). The cost of these is highly variable, even from one region to another. The net operating costs are calculated by subtracting any savings in energy or materials (see section 8.2) from the total cost of equipment operation and maintainance, and the monetary value of such savings is often difficult to estimate accurately.

8.5. Analysis of costs

With the above reservations, cost estimations for specific levels of pollution abatement are given in Tables 8.2 and 8.3.

Table 8.2. indicates the estimated average costs - per ton of pulp manufactured, in 1970 U.S. dollars - required to attain the appropriate set of proposed effluent norms, as laid down in chapter 9 , Table 9.1. These costs are also expressed, in turn, as a percentage of the average 1970 OECD price of the relevant category of pulp. In this way, comparisons can be made with the expenditure for pollution control in 1970 and that foreseen for 1975 and 1980 in the OECD report, expressed as an average over OECD member countries.

The costs to attain the target norms were estimated by considering all relevant available data sources. For each set of data, a graph of pollution control cost vs. pollution index (P.I) was constructed, and the cost read off at the appropriate target P.I. level.

The proposed norms shown in Tables 8.2 and 9.1 were initially chosen as a suitable base for analysis, because they are technically practicable (see chapter 7) ; - in the experience of one member country having a wide variety of discharge/receiving water situations - environmentally desirable ; and they are less severe than present Swedish and proposed U.S. BATEA discharge norms.

Table 8.3 presents the average effluent discharge level per production category in 1970 and estimated for 1975 and 1980, and the corresponding pollution control expenditures, for individual FEC member countries, abstracted from the OECD report. These data are compared with the estimates of the costs required to attain the proposed norms, shown in Table 8.2 and 9.1. The comparable U.S. estimates and norms are also shown.

The following should also be noted with respect to Tables 8.2 and 8.3.

1. The figures reflect the total costs of pollution control. The actual burden on the industry may be much lower, as a result of financial aids provided by public bodies (see chapter 6).
2. For the semi-chemical and sulphite processes, the cost estimates were made with reference to the lower set of discharge levels within each category (see Table 9.1).

As mentioned in Chap.5 the proposed norms are generally comparable to the norms applied in Sweden in 1972, and the proposed US BPCTCA levels, and are in most cases identical to the "Contrat de Branche" values. The latter are the only uniform effluent discharge standards in existence within the EEC, specifically established for the pulp industry, and have proved to be technically feasible and environmentally necessary.

It should finally be noted that the EPA BPCTCA and BATEA levels in this document may be slightly different from the final proposed guidelines and standards. The former refer to the EPA's contractor's suggestions since only the contractor has given price estimates to attain these levels.

The final EPA proposed guidelines and standards are generally stricter than in table 8.3.

8.6. Discussion of results

8.6.1. Bleached Kraft pulp

It can be seen from table 8.2 that to attain a Pollution Index (PI) of 28, the cost is expected to be at most 5-6.5$/ton. This represents about 3 % of the 1970 price of Kraft pulp, and is less than the average pollution control expenditure foreseen by the OECD countries in the Kraft category, for 1980.

Table 8.3 shows that France expects to achieve a PI of 29 Kg/ton by 1980, and Belgium has already surpassed this level.

8.6.2. Raw Kraft pulp

The cost of achieving a P.I. of 12.5 is expected to be between 4.6 and 7.6 $/ton of pulp, i.e. 2.6 - 4.3 % of the 1970 Kraft pulp price. Similarly to bleached Kraft, this is within the average OECD expenditure for 1980, in the Kraft category.

The expected PI in France by 1980 is 21, (table 8.3), which is considerably higher than 12.5, and the projected pollution control costs are considerably lower. On the other hand, Belgium has already attained the latter index.

The U.S. BPCTCA levels envisage a PI of 14 Kg/ton by 1977, with a corresponding cost of about 7.6 $/ton.

8.6.3. Sulphite pulp

As mentioned in 3.3.2, in this production category, recovery of the cooking liquor is only feasible when soluble bases such as sodium or magnesium are used. Table 9.1 thus defines two appropriate pollution discharge levels ; PI of 102.5 for mills with cooking liquor recovery facilities, and 175 for mills without such facilities.

The cost estimates of achieving a PI of 102.5 vary strongly from one country to another (see table 8.3). This is possibly partly due to the different distribution of mills with and without recovery facilities in the different countries.

The estimated costs range from 9 $/ton for Sweden to 23 $/ton for France (see Table 8.2). However, it can be seen from Table 8.3 that France envisaged achieving an average PI of 140, and Germany of 110 by 1980.

8.6.4. Semi-chemical

In this category, the size of the mill is of crucial importance (see chapter 3) since it is considered that recovery of waste is not economically practicable for mills which produce less than 100-150 tons of pulp per day. The proposed target norms reflect this difference ; for mills producing less than 150 tons/day the PI target is 133, whereas for those producing more than 150 tons/day the target is 21.

On the basis of the EPA development report, it would cost 14.5 $/ton and 8 $/ton to attain a PI of 21 Kg/ton, depending on whether sodium or ammonium based cooking liquor respectively are utilized. (Table 8.2)

France forecasts a P.I of 125 by 1980, the Netherlands of 40 by that date. The EPA has proposed BPTCA levels of 30 for this category. (Table 8.2)

8.6.5. Mechanical pulp

As mentioned before, most mechanical pulp mills are part of newsprint manufacturing installations, and it is often difficult to distinguish the pulping stage in order to measure and control the discharges.

However, to enable this category to be included here, a target P.I of 15 kg/ton, corresponding to 5 kg/ton of BOD_5 and 5 kg/ton of suspended solids has been taken as technically and economically practicable.

To attain a P.I of 15 is estimated to cost less than 6 $/ton of pulp. (Table 8.2)

Whereas in France the average PI was expected to be as high as 29 by 1980, in Germany a PI of 5, and in the Netherlands a PI of 8 was envisaged, according to the OECD report.

8.6.6. General evaluation

From Table 8.2 it can be seen that the costs estimated necessary to attain the relevant target norms of Table 9.1 are generally lower, or in line with the expected expenditure on pollution abatement by 1980 averaged over OECD member countries.

Furthermore, Table 8.3 shows that in individual EEC member countries, the average levels of pulp mill pollution discharges estimated for 1980 are often lower or equal to, and only in a few cases higher, than the appropriate norms shown in Table 9.1. The individual estimated cost expenditures in 1980 are also generally comparable to those judged to be necessary (according to Table 8.2) to attain the proposed target norms. However, figures are only available for a few Member States.

TABLE 8.2. COSTS ESTIMATED TO BE NECESSARY TO ATTAIN PROPOSED TARGET NORMS

Production category	Data source	Mill size considered	Target norms (see Table 9.1)			Cost to attain target norms		OECD 1970 average selling price ($/ton)	Expected expenditure on pollution control averaged over OECD countries, expressed as % of 1970 pulp selling price		
			BOD_5 Kg/ton	SS Kg/ton	P.I ($2BOD_5$ + SS)	$/ton	As % of OECD 1970 selling price		1970	1975 (forecast)	1980 (forecast)
Bleached Kraft	OECD(Advanced Tech. study)	500 tpd	9	10	28	3-6.5(1)	1.8-3.7	177(2)	0.7	2.4	approx. 4.5
	EKONO	300 tpd			"	5.8	3.3				
	"	750 "			"	4.4	2.5				
Raw Kraft	EPA	1000 tpd	5	2.5	12.5	7.6	4.3				
	EKONO	750 "			"	4.6(3)	2.6				
Sulphite			45	12.5	102.5(4)			173(7)	1.8	7.9	approx. 10.0
			80	15	175 (5)						
	OECD For France only	all			102.5	23 (6)	13				
	OECD Sweden	"			"	9	5.2				
	OECD U.S.A.	"			"	14	8.1				
	OECD Canada	"			"	17 (6)	9.8				
Semi-chemical			8	5	21 (8)			125	2.0	9.7	-
			60	13	133 (9)						
	EPA NSSC-Na	250 tpd			21	14.5	11.6				
	EPA NSSC-NH_3	250 "			"	8.0	6.4				
Mechanical			5	5	15						
	EKONO	350 tpd				<4.5(b)	3				
	OECD	all			"	<6.0(c)	3.6				

Remarks concerning Table 8.2

(1) Depending on technique : 3 $/ton for best internal, 6.5 $/ton for external only
(2) Weighted average of bleached and unbleached pulp
(3) Costs refer to mills making sack paper
(4) With recovery of cooking liquors
(5) Without recovery of cooking liquors
(6) Extrapolated from PI = 130
(7) Weighted average of bleached and unbleached sulphite pulp
(8) Production capacity $\geq$ 150 t.p.d.
(9) Production capacity $<$ 150 t.p.d.

(b) Newsprint from groundwood
(c) OECD average excluding Canada

Table 8.3.

COMPARISON OF THE TARGET NORMS AND THE COSTS ESTIMATED NECESSARY TO ATTAIN THEM, WITH ANTI POLLUTION EXPENDITURE AND EFFLUENT DISCHARGE LEVELS FORESEEN BY INDIVIDUAL EEC MEMBER COUNTRIES

Production Category	E.E.C. country (OECD data) (or U.S.A.)	Pollution indices and corresponding pollution control expenditures as foreseen by EEC member countries for the OECD enquiry						Target norms		EPA (U.S.A.)			
		1970		1975		1980		Pollution Index	Cost range reqd. to achieve PI (from table 8.2)	BPCTCA (1977)		BATEA (1983)	
		Pollut. Index	Costs $/ton	Pollut. Index	Costs $/ton	Pollut. Index	Costs $/ton			Pollut. index	Envis. Cost $/ton	Pollut. index	Envis. cost
Bleached Kraft	France	134	0.3	44	4.3	29	5.2	28	3-6.5	-	-	-	-
	Belgium	19	7.5	18	10.2	18	-						
Raw Kraft	France	64	0.2	33	0.23	21	0.7	12.5	4.6-7.6				
	Belgium	12	-	12	-	12	-						
	U.S.A. (EPA)									14	7.6	7	11.0
Sulphite	France	485(1)	1.5	359(1)	13.4	140(1)	21.6	102.5(2)	9-23				
	Italy	642(1)	-	620(1)	-	-	-						
	Germany	256(1)	-	195(1)	-	110(1)	-						
Semi-chemical	France	320(3)	1.8	302(3)	11.3	125(3)	16.7	21(4)	8-14.5				
	Italy	224(3)	-	206(3)	25	-	-						
	Netherlands	58(3)	3.6	50(3)	3.6	40(3)	3.6						
	U.S.A.(EPA) NSSC - Na									30	13.7	12	18.4
	U.S.A.(EPA) NSSC - HN_3									30	4.3	12	9.0
Mechanical (Including newsprint)	France	58	0.3	44	4.3	29	5.2	15	<6.0				
	Italy	47	0	40	2.0	-	-						
	Germany	5	0.5	5	0.6	5	1.4						
	Netherlands	51	0	8	5.7	8	5.7						

Remarks (1) No distinction between mills using and not using recovery
(2) For mills using recovery
(3) No distinction made by mill size
(4) For mills producing > 150 tpd

9. CONCLUSIONS AND PROPOSALS

9.1. The pulp industry has the potential to be a highly polluting industrial sector. Pulp mill effluent can contain appreciable quantities of suspended solids, can severely deplete the oxygen content of the receiving watercourse, can contain toxic substances, and can discolour and cause foaming in the receiving watercourse. Whether or not this potential to pollute is realized however will depend on :

- the type of pulp producing process employed ;
- the volume and type of effluent discharged ;
- the environmental characteristics of the medium receiving the discharge ;
- the extent to which Member states have legislated against the discharge of waste

9.2. In terms of BOD_5 and suspended solids the worst pollution problems are likely to arise in the sulphite pulping process : for a sulphite mill with standard 1970 technology (not taking into account the effects of external control measures) the effluent can have a pollution load of 450 kg/ton BOD_5 and 60 kg/ton suspended solids*. Such a pollution load can be seen to be substantial when compared with the kraft process of pulping, in which recovery of liquor takes place**. In the latter case the pollution loads can be as low as 40 kg/ton BOD_5 and 10 kg/ton suspended solids.

9.3. To date France is the only member country to have drawn up legislation specific to pulp mill effluent. Belgium has drawn up environmental quality standards specifically applicable to a number of industrial sectors including the paper and pulp sector. Some other countries use "guidelines" which are part of the general environmental legislation.

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* If the cooking liquor is recovered, the BOD_5 and suspended solids are reduced to 250 kg/ton and 50 kg/ton respectively - recovery however is not possible if the traditional calcium base or an ammonium base are used.

** The recovery of cooking liquor is much more common in the kraft process than in the sulphite process.

9.4. There are numerous technologies available for reducing the pollution load of pulp mill effluent. These technologies can take the form of internal measures (i.e. measures which reduce the cause of pollution at their origin by modifying the manufacturing process) or external measures (i.e. treatment of effluent discharged during and after the manufacture of the pulp). It must be emphasized however that the introduction of such technologies will require the industry to incur extra costs, and that in some mills such costs could be cause for significant concern.

9.5. Whilst, for reasons outlined in section 8.1, it has not been possible to draw firm conclusions from the cost data available, the following should be highlighted :

- the unit costs of achieving a particular effluent standard are likely to vary from one country to another. This can be seen from table 8.2 where for sulphite mills the costs of achieving a PI of 102.5 are estimated from $ 9 per ton to $ 23;
- the unit costs of control are likely to differ substantially depending on the size of operating unit. In the case of semi-chemical pulp, for example, the cost of achieving a PI of 21 in mills producing more than 50,000 tons per annum is estimated to be $ 8-14.5 per ton, depending on the type of cooking base used. Data provided by member countries, not disaggregated by mill size, indicate costs of up to $ 25 per ton for PI indices which are well above 21;
- the more modern plants are likely to face much lower unit costs of pollution control than the older plants. This is one of the reasons for the sulphate pulp mills generally facing lower unit costs than the sulphite mills , the former process being more recent;
- the percentage increase in costs, relative to the price of pulp, likely to arise out of controlling pulp mill effluent to the standards proposed in Table 9.1 could be quite low relative to the increases in the costs of other factors of production which have taken place in recent years. In the case of bleached kraft pulp, for example, the increase in costs could be less than 5 %, and in the case of the sulphite and semi-chemical categories the cost increase could be of the order of 10 %. These cost increases assume a base level of no controls.

Furthermore, it seems likely that the percentage of costs accounted for by the pollution abatement measures necessary to achieve appropriate discharge norms in Table 9.1 would presently be lower than estimated above, because the price of pulp has risen very much more rapidly since 1970 than that of the required pollution control equipment.

9.6. This then is the situation which the Commission has had to consider in preparing its proposals. The approach followed is essentially a straightforward one. It covers :

- Uniform emission standards
- Flexibility of application
- Possibility of financial aids at national level
- Possibility of exceptions
- New technology

9.7. Uniform emission standards

The Commission proposes the adoption on a Community basis of emission standards for the pulp industry, as being the most appropriate and practicable first step towards reducing pollution from this sector. These standards are set out in the table below. They are differentiated according to the type of process (as noted above in para.2 the pollution problems vary according to the process). They are differentiated also to some extent according to the type of treatment used. For example the proposed norms for the discharge of suspended solids vary according to whether or not aerated lagoons are available for the reduction of oxidizable matter.

In general, these norms can be considered as minimum, and it can be seen from Figs. 5.1.A to 5.1.E that they are in most cases less severe than those propored or in use in some major competitor non-member countries.

Table 9.1.

TYPE OF PROCESS		A	B (1)	B (1)
		SS kg/ton	BOD kg/ton	SS kg/ton
KRAFT	raw	2,5	5	10
	bleached	10	9	20
SULPHITE	with elimination or reutilization of waste liquors	12,5	45	50
	without elimination or reutilization of waste liquors	15	80	85
MI-CHEMICAL	production capacity >150 tons/day	5	8	5
	production capacity <150 tons/day	13	60	60
MECHANICAL		5	5	5

1) to be used if reduction of oxidizable content is achieved by aerated lagoon

The Commission believes that the adoption of such norms over a period of time by Member states would help to ensure a considerable initial reduction of the pollution resulting from the pulp industry, while still permitting them the necessary latitude to take into account both local environmental and economic considerations (see parag. 8,9, 10, and 11 below).

9.8. Flexibility of application

As noted above in parag. 1, the actual pollution caused by a particular factory will vary according to, amongst other things, the volume of effluent and the environmental characteristics of the receiving medium. It was also noted that the unit costs of achieving a particular effluent standard are likely to vary from one country to another, and also according to the size of the operating unit.

The Commission therefore believes that Member states should enjoy a wide measure of flexibility in applying the uniform emission standards set out in Table 9.1. Specifically, provided that in the case of already existing plants the emission standards are achieved by the end of a ten year period, Member states should be free to work out a programme of pollution reduction, case by case, which takes into account all the necessary factors, both economic and environmental. Besides having the possibility of varying the timing of the pollution reduction programme, it should of course also be open to Member states to impose emission standards which are more severe than these basic standards, where local conditions call for this.

In the case of new plants, as well as new capacity which is added to already existing plants, the limit within which the emission standards of Table 9.1. should be respected would be twelve months at the latest after the date the plant has come into operation.

9.9. Financial aids

It is recognized that the application of the proposed discharge norms may in some instances create undesirable economic problems and may therefore necessitate some special aids. The Commission is preparing a communication to Member states on this matter.

9.10. Possibility of exceptions

The Commission recognizes that, even though there is every possibility for the suggested emission standards to be applied flexibly so as to take into account different environmental and economic situations, these standards may still not provide sufficient flexibility where certain discharges to tidal waters are concerned. Factors which may influence the pollutant effect of a particular discharge include the state of the tide ; the direction of local currents ; the point of discharge ; in the case of estuaries, the geographical shape of the estuary ; and the quantum of organic matter discharged.

In the light of this the Commission recognizes that there might be a case for differentiating between the conditions imposed on discharges to tidal waters and those imposed on inland rivers and streams. However, there may certainly be cases where the imposition of the norms of Table 9.1. on plants discharging into tidal waters is entirely justified. Moreover, there will be cases where the discharge to tidal waters (because of amenity considerations, for example) may be subject to operational conditions which in effect render the norms even more severe. But in other cases these norms, or the parameters in which they are expressed, may not necessarily be relevant. The Commission believes that exceptions could be permitted in the case of those discharges to tidal waters where it can be demonstrated that, under the actual conditions of discharge, no appreciable degradation results in the quality of the receiving water. The evaluation of what constitutes an "appreciable degradation" would of course need to be undertaken in the light of any environmental quality objectives (immission standards) which may exist for the water in question and as a function of the use to which the water is put.

9.11. New technology

The Commission is presently considering whether the need exists for action at the Community level on research and development in the field of pollution control technology specifically applicable to the pulp industry. It will send a special paper on this problem within a very short time.

TABLE 5.1.

SUMMARY OF EEC MEMBER STATES' ENVIRONMENTAL LEGISLATION APPLICABLE TO EFFLUENT DISCHARGE FROM THE PULP INDUSTRY

Country	Emission		Immission		Legislations: General guidelines		Individual treatment or ...
	Effluent guidelines	Effluent standard	guidelines	standards	Main aspects	proposed standards	
BELGIUM	No	Yes	No	Yes	Arrêté Royal 23/1/74, etc : Controls effluent discharge into 1) public sewers 2) surface waters 3) aquaducts	Fixed for all industry. May be extended to individual industrial sectors.	Yes
FRANCE old mills	No	Yes	No	Yes	- By the act of 16th December 1964 polluters pay a charge for pollution discharged and receive help for financing antipollution investments. - Minimum discharge standards are fixed in uniform manner. Can be locally stricter. - An agreement signed with the Minister of the Environment covers a programme of pollution reduction for chemical and semi-chemical pulp mills. Deadline in 1976 with all mills provided with biological treatment.	Maximum discharge allowed (kg/tonne)		Yes
FRANCE new mills	No	Yes					
GERMANY	Yes	No	—	No	Draft législation on effluent discharge 29/3/74 : Imposes taxes as a function of the noxiousness of the effluent. Many aspects of water pollution are covered by regional (Länder) legislation.	Units of noxiousness determined by taking into aocount suspended solids content, chemical oxygen demand and toxicity of the effluent.	Yes
ITALY	Yes	No	No	No	According to the Health Act of 1934 authorization of discharge is required.	No standards presently applied to discharge of waste water.	Yes
[illegible]	Yes	No	Yes	No	Legislation is based on maintenance of water quality as required by each use. Amendments to existing legislation are under consideration.	Standards related to SS - BOD - toxicity - colour - oil - ammonia, etc. No national standards. Values generally used are : BOD = 20 mg/l max. SS = 30 " " Can be more stringent.	[illegible]

Maximum discharge allowed (kg/tonne)	Primary treatment	Secondary treatment*	
	SS	BOD5	SS
kraft unbleached	2.5	5	10
bleached	10	9	20
Sulphite :			
with liquor recovery	12.5	45	50
without " "	15	60	65
Semi-chemical :			
more than 150 tons/day	5	8	5
less " " " "	15	60	60

* biological treatment by aerated lagoon

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Country	Emission		Immission		Legislation : General guidelines		Individual authorisation or permission
	Effluent guidelines	Effluent standard	guidelines	standards	Main aspects	Proposed standards	
NETHERLANDS	Yes	No	Yes	No	Polluters pay a tax based on COD and nitrogen content	No precise standards, but average is about 30 ppm of suspended solids 20 ppm of BOD_5 Mercury prohibited	Yes
IRELAND	Yes	No	Yes	No	Effluents are divided into four classes according to their toxicity, and permissible conditions are differentiated according to the class D effluent		Yes
DENMARK	Yes	No	Yes	No	Act n° 372 of June 13, 1973. Permission to discharge waste waters into water courses, lakes or the sea is required.		Yes

TABLE 5.2.

Summary of OECD Member countries legislation relevant to pollution by the pulp and paper industry, up to 1972

(taken from the OECD report on "Pollution by the Paper and Pulp Industry - Paris 1973)

COUNTRY	MAIN ASPECTS OF LEGISLATION	PROPOSED STANDARDS*
AUSTRIA	Most effective methods available relative to cost	Specific to each mill site : SS, $KMnO_4$/day
BELGIUM	3 river categories N° 1 N° 2 N° 3 Water treatment companies to be created. Receiving water body quality is criterion.	t = 25°C O_2 content 70 % of saturation (min) t = 20-25°C " 50-70 % " t = 30°C " > 3 mg/l Settling matters after 1H (all categories) : 1,5 ml/l Load discharges based on BOD, SS, volume (specific to each mill site).
CANADA	Best practicable technology to be applied to each plant.	BOD standards (untreated effluent) : lbs BOD/ADT Sulphite 55 % or less yield 255 55-65 " " 170 more than 65 150 Sulphite bleaching 35 Kraft pulping 64 Kraft bleaching 27 NSSC 80 SS standards based on each process components
FINLAND	Discharge of waste submitted to permit only, up-to-now. Guidelines exist.	Based on water quality, health, etc. Guidelines for SS and BOD (in kg/tonne) : Semi-chemical pulp SS 7-12 BOD - Sulphite pulp 15-25 60-80 Sulphate pulp 10-18 20-35 Newsprint 5-10 3-10 Paper and Board 3-12 4-10 Fiber board 9-10 - Eutrophication taken into consideration.
FRANCE	- By the act of 16th December 1964 polluters pay a charge for pollution discharged and receive help for financing antipollution investments. - Minimum discharge standards are fixed in uniform manner. Can be locally stricter. - An agreement signed with the Minister of the Environment covers a programme of pollution reduction for chemical and semi-chemical pulp mills. Deadline in 1976 with all mills provided with biological treatment.	Maximum discharge allowed (kg/tonne) — Primary treatment: SS; Secondary treatment*: BODs, SS kraft unbleached 2.5 / 5 / 10 bleached 10 / 20 / 20 Sulphite : with liquor recovery 12.5 / 45 / 50 without " " 15 / 80 / 85 Semi-chemical : more than 150 tons/day 5 / 8 / 5 less " " " " 15 / 60 / 60 * biological treatment by aerated lagoon
GERMANY	- Current regulation is based upon a 1957 Federal act. A proposal to introduce a tax on discharges of pollution is examined. - A list of standards related to waste water treatments has been prepared, based on : A = Cellulose B = Cellulose and pulp C D E F = Cellulose with wood pulp, dyes, waste paper or rags, straw.	Standards based on : Mechanical treatment Settling matters : not practically measurable Insoluble matters : 50-100 mg/l pH : 5.5-9 Chemical treatment Settling matters : 0.5-0.7 mg/l Insoluble matters : 20-100 mg/l pH : 5.5-9 $KMnO_4$: 150-400 mg/l BOD_5 : 50-100 mg/l Biological treatment Settling matters : 0.3 mg/l Insoluble matters : 20-30 mg/l $KMnO_4$: 100-200 mg/l BOD_5 : 20-40 mg/l
ITALY	According to the Health Act of 1934 authorization of discharge is required.	No standards presently applied to discharge of waste water.

* SS = Suspended solids.
BOD = Biological oxygen demand.

TABLE 5.2. Cont'd

COUNTRY	MAIN ASPECTS OF LEGISLATION	PROPOSED STANDARDS
JAPAN	Under the 1971 act all mills will have to observe minimum standards all around the country (to be applied in successive steps between 1972 and 1976). Can be locally stricter.	Standards for 1976 deadline (expressed in ppm) BOD COD SS Semi-chemical 600 600 150 Sulphite (paper grades) 300 300 150 Sulphite (dissolving grades) 600 800 150 Sulphate (dissolving grades) 120 300 150 Sulphate (paper grades) 120 200 150 Paper and board 120 120 150
NETHERLANDS	Polluters pay a tax based on COD and nitrogen content.	No precise standards, but average is about 30 ppm of suspended solids 20 ppm of BOD_5 Mercury prohibited.
NORWAY	Ministry of Environment has been created in 1972. According to new legislation (1971) all mills must apply for permission for discharge.	No specific standards.
SPAIN	Water courses divided into 4 categories, and waste water discharges classified according to their harmfulness.	Main standards for pulp and paper industry to be applied with sufficient delay.
SWEDEN	Protection of the environment by using the best practicable means. The regulations are based on the Environment Protection Act - 1969 - and a number of orders concerning subsidies for antipollution investments. Standard performances for discharge are not discharge standards as they can be lowered when necessary.	Standard performances (kg/tonne) BOD_5 from : A B C D E - Barking 0-6 0-6 0-6 0-6 0-6 - Washing 1-18 1-10 3-7 5-30 - - Grinding - - - - 10-30 - Condensate - 1-12 5-20 10-30 - - Bleaching 2-5 10-20 0-15 2-5 - SS 2-5 2-5 2-5 2-5 2-5 A = Mechanical pulp B = Sulphate C = Sulphite D = Semi-chemical E = Fibre board
SWITZERLAND	Principle is to keep the receiving water at least in the "Mesosaprobic beta" quality. Federal Act - July 1972 - stipulates physical, chemical, biological characteristics of effluent. Certain standards apply specifically to pulp and paper industry.	Standards for pulp and paper industry BOD_5 = 25 mg/l in 24 h (80 mg/l peaks permitted) $KMnO_4$ = 80 " " (150 mg/l peaks permitted) Sulphides = 1 mg/l in S^{-2} Sulphites = 10 mg/l in SO_3^{-2}
UNITED KINGDOM	Legislation is based on maintenance of water quality as required by each use. Amendments to existing legislation are under consideration.	Standards related to SS - BOD - toxicity - colour - pH - ammonia, etc. No national standards. Values generally used are : BOD = 20 mg/l max. SS = 30 " " Can be more stringent.
UNITED STATES	The "Federal Water Pollution Control Act Amendments of 1972" declares that it is the national goal that the discharge of pollutants into the receiving water bodies be eliminated by 1985. In addition to this goal, specific interim requirements are stipulated. They relate to the application of the "best practicable control technology currently available", the "best available technology economically achievable", or the "best available demonstrated control technology". Interim guidelines have been issued by the Environmental Protection Agency.	Interim guidelines SS lb/ton; BOD_5 lb/ton Kraft Coarse paper, liner-board 5 6 Newsprint 6 8 Bleached and unbleached 10 10 Bleached 10 12 Sulphite Paper 20 40 Dissolving 20 80 NSSC 15 25 Ground-Wood Unbleached 9 5 Bleached 10 6 De-inking - 25 Paperboard 5 5 Paper Coarse 5 5 Fine (<8% filled) 8 6 Book (>8% filled) 15 6 Tissue 6 8

NOTES CONCERNING FIG. 5.1.A. to 5.1.E.

I. General

1) Unless otherwise stated below (Section II), all the data shown are taken from the OECD study on pollution by the Paper and Pulp Industry, NR/ENV/73.13. Since this report was compiled in 1970, some of the data are now out of date. In particular, Swedish and U.S. norms have become very much more stringent.

2) Dotted lines represent ranges of permissible discharge levels.

3) In some cases, datum for a particular Member state is bracketed eg. (B). In this case a discharge level estimate (OECD) rather than an actual norm is shown.

II. Specific

Fig. A :

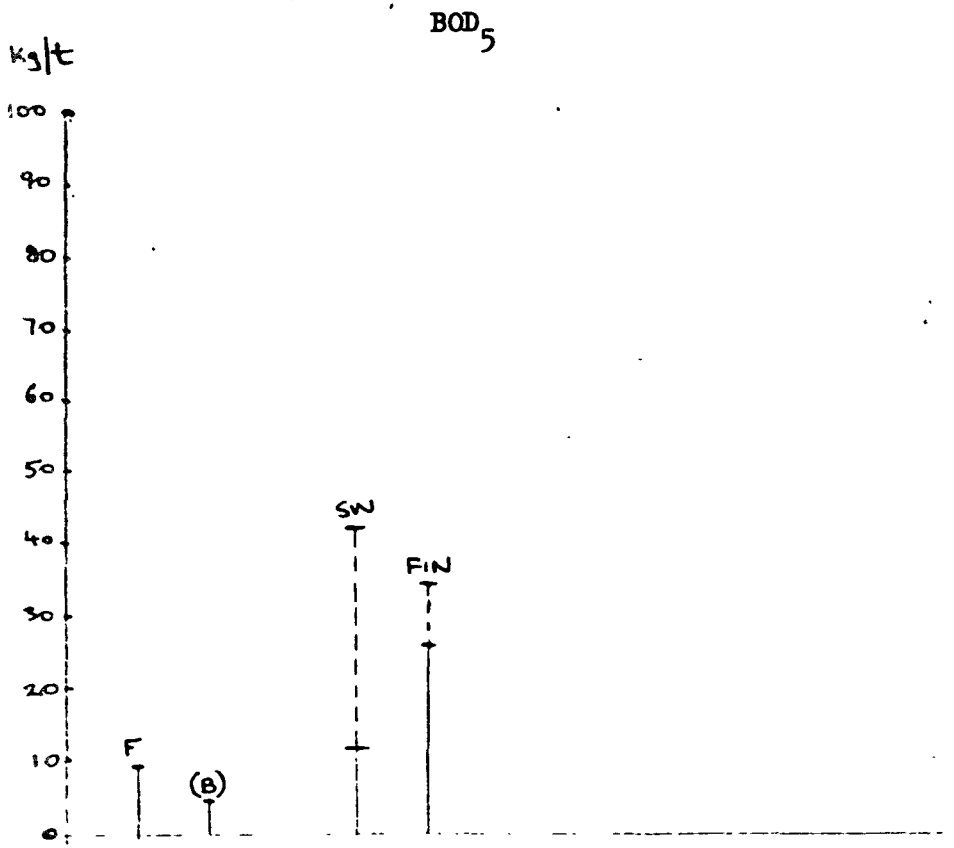
Fig. B : USA (1) refers to the recent EPA BPCTCA level (Best practicable control technology currently available) to be achieved by 1978. USA (2) refers to BATEA (Best available technology economically achievable) level to be attained by 1983.

Fig. C : F (1) applies to installations with a daily production less than 150 ton. F (2) to those producing more than 150 tons per day.

Fig. D : F (1) applies to mills which do not recover cooking liquors. F (2) applies to those which do practise recovery.

Fig. E : Data generally applies to integrated newsprint factories.

FIG. 5.1. A BLEACHED KRAFT PULP: DISCHARGE NORMS



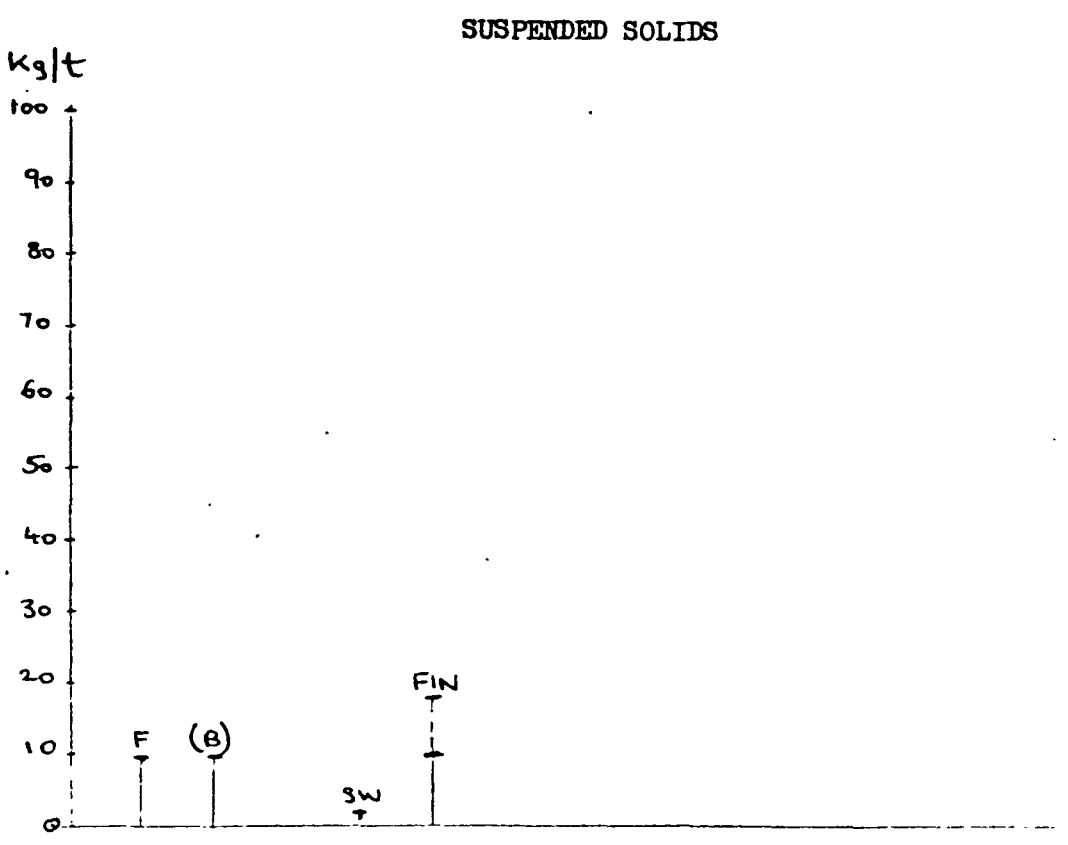
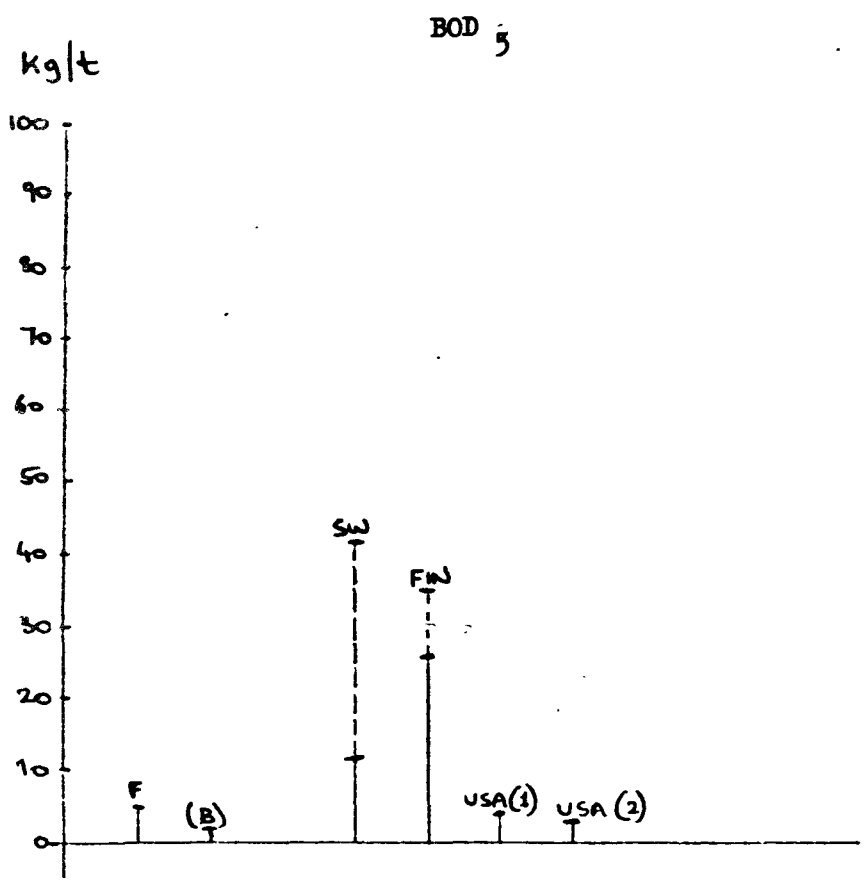


FIG. 5.1.B. RAW KRAFT PULP: DISCHARGE NORMS



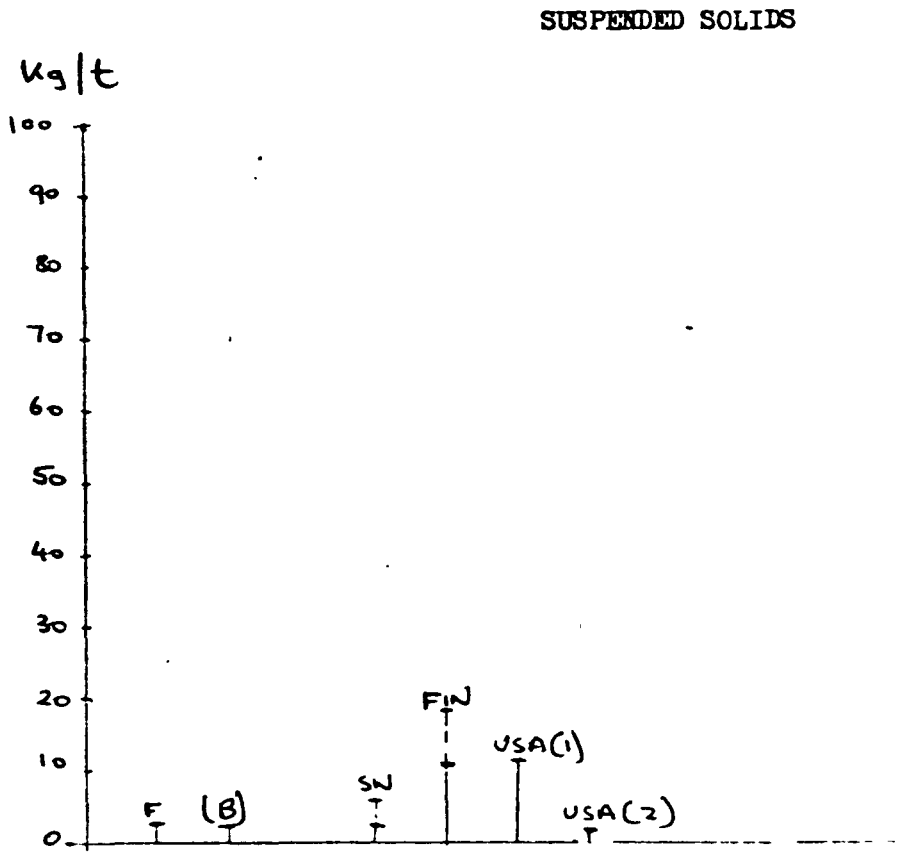
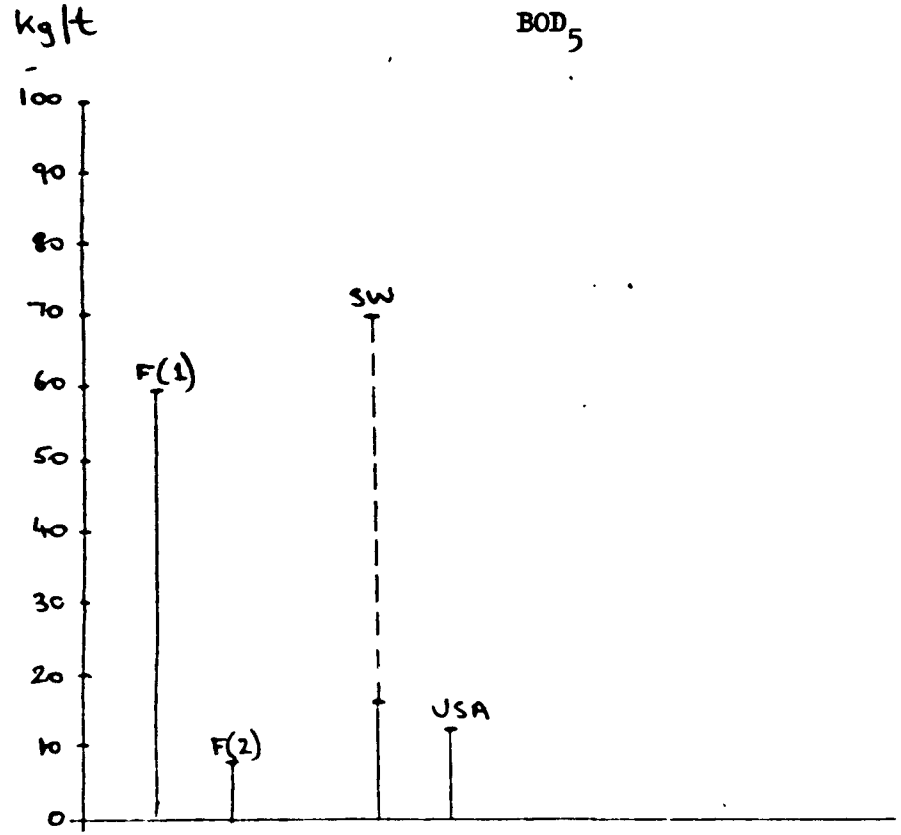


FIG. 5.1.C. SEMI-CHEMICAL PULP: DISCHARGE NORMS



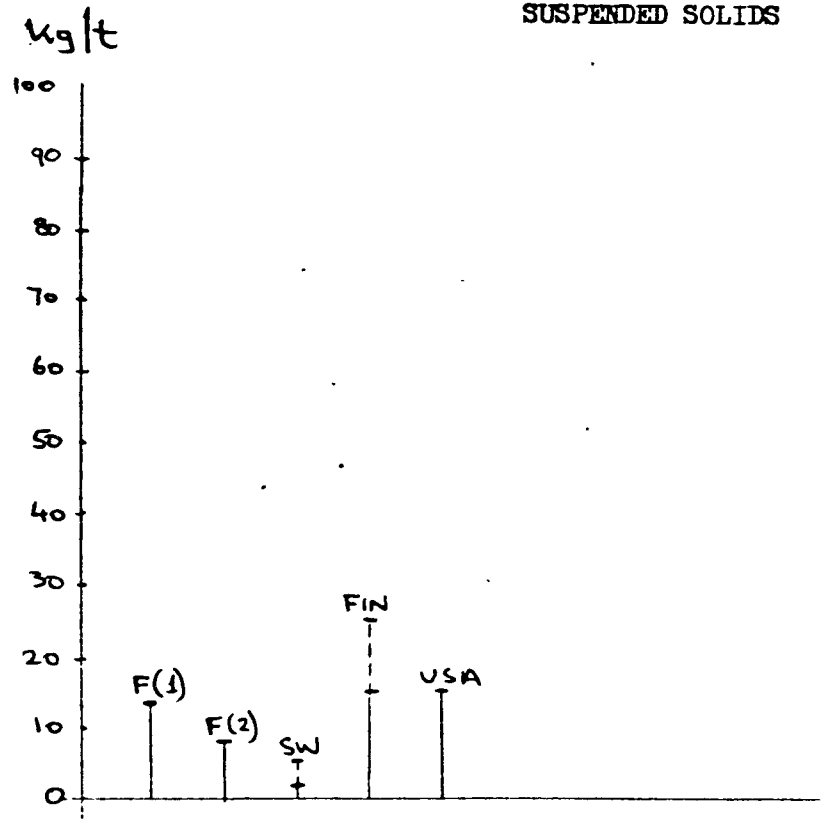
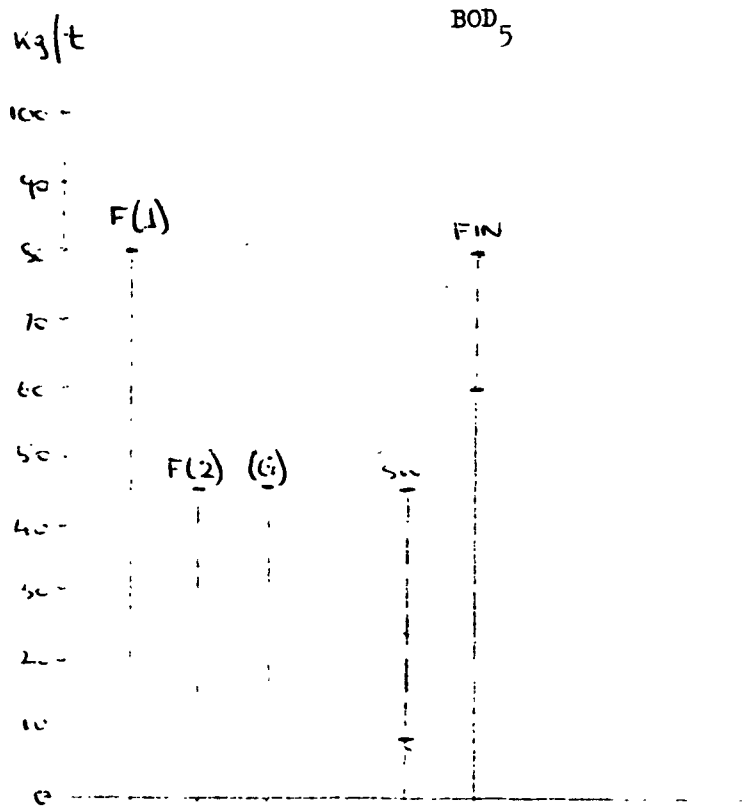


FIG. 5.1.b. SULPHITE PULP: DISCHARGE NORMS



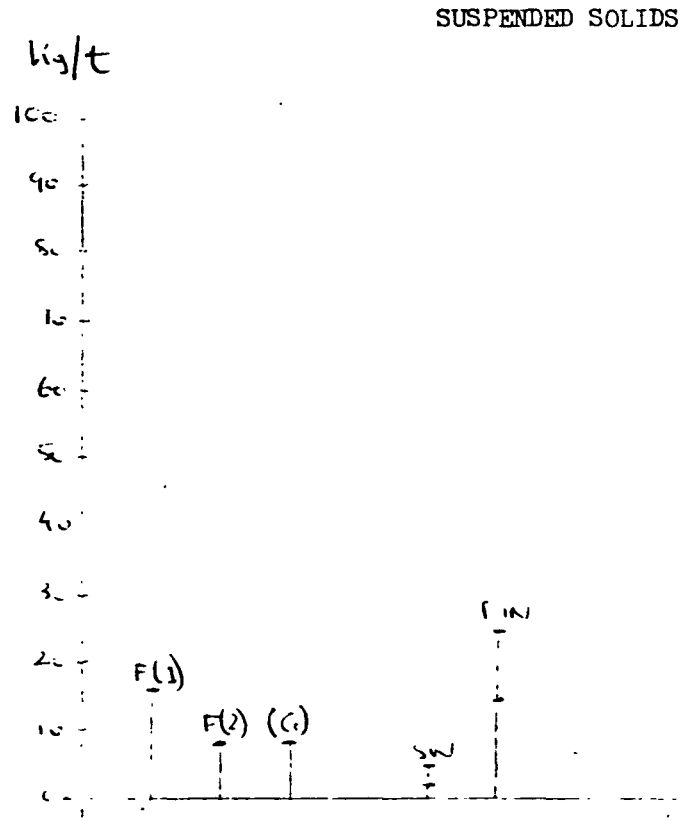
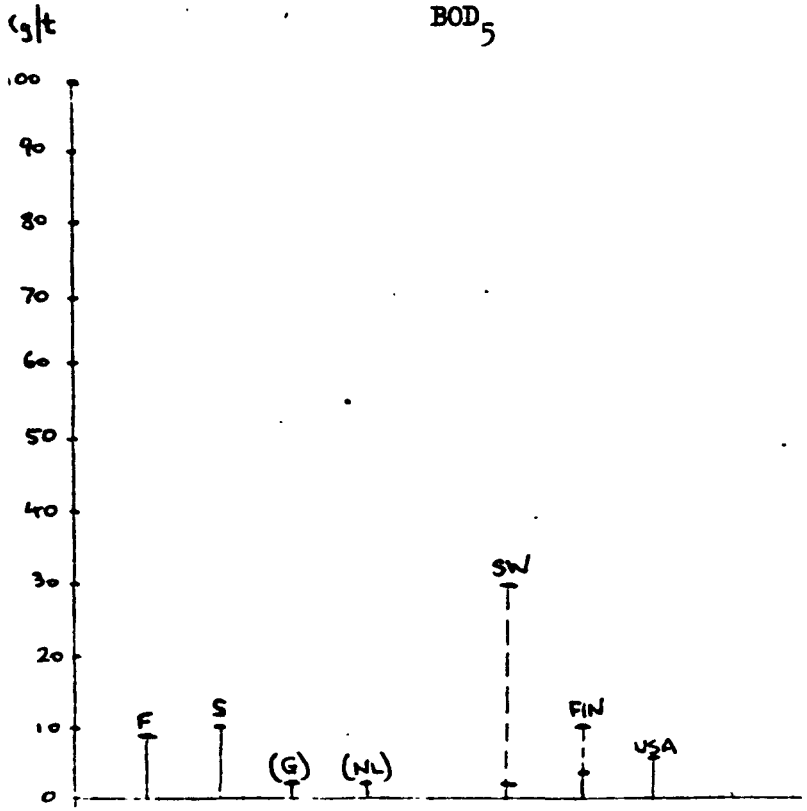


FIG. 5.1.E. MECHANICAL PULP (NEWSPRINT): DISCHARGE NORMS



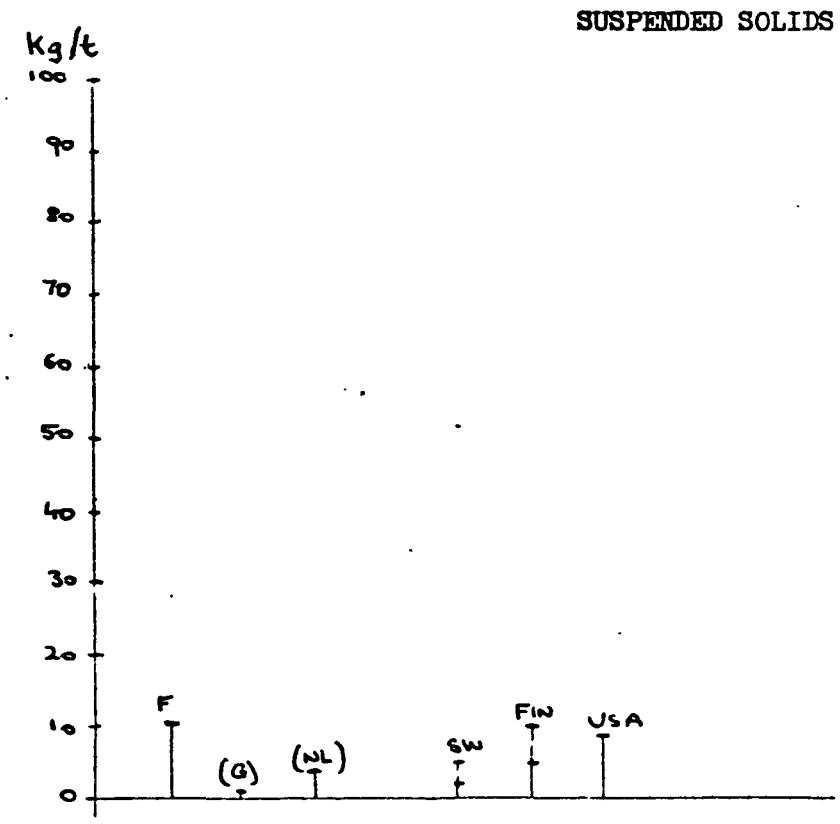


TABLE 6.1.A

Examination and comparison of financial and other forms of aid granted to the pulp and paper industries by the Member States with a view to pollution abatement

A detailed examination of the financial aid which the States, the regional and local authorities or agencies or various public institutions have granted to the pulp and paper industries appears in the attached tables.

These measures have been divided into the following three categories:

- subsidies
- tax relief
- loans.

Only the following three types of aid are considered:

1. General aid granted for pollution abatement
2. Aid granted to the pulp and paper industry
3. Aid granted to the pulp and paper industry for the specific purpose of pollution abatement.

The table below summarizes their application in the Member States:

./.

	Subsidies		Relief		Loans	
		Type		Type		Type
D	0		yes	1	yes	1
B	yes		0		0	
F	yes	3[1]	yes	1	0	
I	0		0		?	
NL	?		?		?	
GB	yes	1	yes	1	yes	1[2]
IRL	0		0		0	
DK	0		0		0	

This aid is intended specifically for pollution abatement purposes, but the pulp and paper industry can benefit from other measures, either under general industrial policy (e.g. reduction of unemployment and regional development) or under specific sectoral policies (e.g. rationalization of production capacity).

This examination shows that:

- two countries grant no aid:

  Denmark
  Ireland

- the same may also be true of Italy (official documents not received)
- the Netherlands has not supplied the information requested
- four countries grant aid:

./.

[1] Chemical and semi-chemical pulp only.

[2] Restricted to plants jointly owned by industry and local authorities.

the Federal Republic of Germany, through:

tax relief,

low-interest loans (on investments of DM 132 million in 1972)

France, through:

anti-pollution subsidies (maximum 10%) to the chemical and semi-chemical pulp industries,

tax relief

the United Kingdom, through:

subsidies (20-22% of the capital cost) in development areas,

tax relief,

low-interest loans for purification plants jointly owned by industry and local authorities.

Belgium, through :

anti-pollution investment aids

Except for the French subsidies, these are general aids for pollution abatement.

In the absence of adequate information it has not been possible to assess the relative importance of the aid granted.

The aid granted by the United Kingdom is also intended for new plants.

TABLES 6.1.B

FINANCIAL AID to the PULP and PAPER INDUSTRIES

GERMANY — TAX RELIEF

Summary of aid provided for:	Amortization over five years of 50% of the plant and 30% of the buildings (to be deducted from income tax)
Date and reference:	(a) para. 79 Einkommensteuer - Durchführungs Verordnung (b) para. 82 " (c) para. 82 E "
Scope:	a/ Water b/ Air c/ Noise and vibrations a/-c/ are environmental policy measures, not restricted to the pulp and paper industries
Term:	a/ 1 January 1955 to 31 December 1974 b/ 1 January 1957 to 31 December 1974 c/ 1 January 1965 to 31 December 1974
Amount:	" - "
Financing:	
operating costs	No
capital cost	Yes
internal measures	Yes
external measures	Yes
Existing plants:	Yes
New plants:	No
Remarks:	Closing date: 31 December 1974
Probable developments:	In the rapporteurs' draft on the income tax reform, it is stated that the Federal Government is of the opinion that accelerated amortizations are the obvious method of granting financial aid for environmental protection, since they have made an effective contribution to investment growth. In order to develop investments further, the current amortization facilities are therefore undergoing greater coordination and are being appreciably extended and strengthened. Relevant details are to be found in Sections 168 and 196 of the reform draft.

FINANCIAL AID to the PULP and PAPER INDUSTRIES

GERMANY	Federal Authorities	LOANS
Summary of measures:		ERP loans bearing interest at 25% less than the normal rate (currently 5%)
Date and reference:		The following ERP laws respectively -
		1972: Bundesgesetzblatt, Teil I, No 37 v.28.4.1972-Kap.1 - Tit.862 09 Kap.7 - Tit.862 01
		1973 (draft) Kap.1 - Tit.862 10 Bundesdrucksache 7/479 v.17.4.1973 same title
Scope:		a/ Water b/ Air Environmental measures covering all enterprises and all municipalities (not restricted to the pulp and paper industries)
Term:		One year
Amount:		DM 63 million granted between 1960 and 1971 (53 loans for 32 installations with a total value of DM 178 million)
Financing:		
operating costs		No
capital cost		Yes
internal measures		Yes
external measures		Yes
Existing plants:		Yes
New plants:		No
Remarks:		General provisions relating to anti-pollution measures, for enterprises and municipalities

Germany : Loans (cont'd)

	Purification of:	
	Water	Air
	DM million	DM million
1968	13.5	5
1969	13.5	5
1970	20	10
1971	147	12
1972	162	20
1973 (draft)	200	30

Probable developments: In view of the importance of environmental protection, it is likely that in the next few years, funds for financing the abatement of water and air pollution and pollution by wastes will again be made available under the ERP annual plans. It is not yet possible to foresee the total amount of financial aid for individual schemes, since the ERP laws are laid down for one year only.

FINANCIAL AID to the PULP and PAPER INDUSTRIES*

UNITED KINGDOM	SUBSIDIES
Summary of measures provided for:	Between 20 and 22% of capital costs, in development areas
Date and reference:	Industry Act passed by Parliament in 1972
Scope:	All anti-pollution measures
Term:	Indefinite
Amount:	Unavailable
Financing:	
operating costs	No
capital cost	Yes
internal measures	Yes
external measures	Yes
Existing plants:	Yes
New plants:	Yes
Remarks:	Facilities granted for all investments and all industries

*United Kingdom reply to Annex 2 of the OECD questionnaire sent out under cover of letter NR/PL/72.206 of 25 October 1972.

FINANCIAL AID to the PULP and PAPER INDUSTRIES

UNITED KINGDOM	TAX RELIEF
Summary of measures provided for:	The cost of the installation can be entirely amortized in the first year, but if there are no profits, amortization may be postponed until a profit is shown
Date and reference:	
Scope:	All anti-pollution measures
Term:	Indefinite
Amount:	Unavailable
Financing:	
operating costs	No
capital cost	Yes
internal measures	Yes
external measures	Yes
Existing plants:	Yes
New plants:	Yes
Remarks:	Facilities granted for all types of investment and to all industries

FINANCIAL AID to the PULP and PAPER INDUSTRIES

UNITED KINGDOM	LOANS
Summary of measures provided for:	Restricted to purification operations conducted jointly by local authorities and industry. Rate of interest 1% below normal, on the whole of the investment
Date and reference:	Part 9 of the Local Government Act passed by Parliament in 1933
Scope:	Water
Term:	Indefinite
Amount:	Unavailable
Financing:	
operating costs	No
capital cost	Yes
internal measures	Yes
external measures	Yes
Existing plants:	Yes
New plants:	Yes
Remarks:	Applies to all industries.

If the industrial effluent is not treated by the entrepreneur but by the local authority together with domestic sewage, the entrepreneur must bear both the capital cost and the operating costs of any new purification equipment that becomes necessary. The local authorities are, however, authorized to borrow from the Government at a rate of interest not more than 1% below the normal rate. The entrepreneur thus has a slight indirect advantage, when he repays his share of the capital cost, in making a proportional contribution to the repayments of the local authority's loan. The treatment plants remain the property of the local authority.

FINANCIAL AID to the PULP and PAPER INDUSTRIES[1]

FRANCE	SUBSIDIES
Summary of measures provided for:	Maximum of 10% of investments
Date and reference:	Agreement of 12 July 1972 between the Minister for the Environment and COPACEL relating to the financing of a programme for the reduction of pollution from the paper pulp industry
Scope:	Water
Term:	Programme to be completed by 1977
Amount:	FF 7 million per annum
Financing:	
operating costs	No
capital cost	Yes
internal measures	Partial
external measures	Yes
Existing plants:	Yes
New plants:	No
Remarks:	- restricted to chemical and semi-chemical pulp - aid to be repaid by the firms if the anti-pollution objectives are not attained[2] - aid granted only for plants existing on 1 January 1972[2]

[1] French reply to Annex 2 of the OECD questionnaire sent out under cover of letter NR/PL/72.206 of 25 October 1972.

[2] Draft record of the EEC meeting of 28 May 1973.

FINANCIAL AID MEASURES to the PULP and PAPER INDUSTRIES

FRANCE

Tax abatements and write-offs

Summary of measures provided for :

a) Fixed installations (non-movables)

Exceptional write-off of 50% of their cost against the results of the current financial year at the time of completion of construction.

b) Equipment

Decremental write-off at a rate of 37.5%; equivalent to writing them off on a straight-line basis over six and two thirds years at a rate of 15% year.

Date and reference :

Scope :

Term : **31 December 1975**

Amount :

Financing :

. operating costs

. capital cost

- internal measures

- external measures

Existing plants :

New plants :

Remarks : **Special duty for anti-pollution plant for all industries.**

FINANCIAL AID TO THE PULP AND PAPER INDUSTRIES

BELGIUM	SUBSIDIES
Summary of measures provided for :	Between 30 and 60% of the investment costs, according to the date of application for aid.
Date and reference :	Royal Decree of 23 January 1974, concerning State intervention for complementary investments made by existing industrial establishments for special treatment of their used water.
Scope :	Used water
Term :	State intervention is granted between 1 January 1974 and 1 May 1979
Amount :	
Financing :	operating costs : no capital cost : yes internal measures : no external measures : yes
Existing plants :	yes
New plants :	no

Remarks :

1) aids given to all types of industrial enterprises (not limited to paper and pulp sector)
2) aids only given to factories in existence on 15. 2. 1974.
3) State intervention is fixed at 50% of investment costs for work carried out between 1 May 1971 and 15 February 1974.
4) the subsidy is returnable by the enterprise, if the relevant pollution reduction objectives are not achieved.

FIGURE 7.1.

SCHEMATIC ILLUSTRATION OF THE CHEMICAL PROCESS FOR THE MANUFACTURE OF WOOD PULP