An Economic, Technical and Biological Review of the British Columbia Council of Forest Industries (COFI) Report : Sustainable Development and the B.C. Pulp and Paper Industry

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AN ECONOMIC, TECHNICAL AND BIOLOGICAL REVIEW OF THE BRITISH COLUMBIA COUNCIL OF FOREST INDUSTRIES (COFI) REPORT: SUSTAINABLE DEVELOPMENT AND THE B.C. PULP AND PAPER INDUSTRY (MARCH 1990)

REGIONAL REVIEW REPORT 90-1

BY

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(as amended February 1991)

REVIEW NOTICE

Review reports are prepared by Environment Canada to present technical commentaries of significant position papers or reports prepared by industry. These reviews are intended to highlight areas where opinions expressed by industry on certain issues may require further detail in order to present a broader perspective. The assessment and analyses contained herein are based on the work of professionals employed by Environment Canada, however it should not be assumed that this document is endorsed by the Federal government or accurately reflects the policy of the Department of the Environment.

This document was sent to the Council of Forest Industries of British Columbia (COFI) for comment prior to public release. Even though the comments and opinions of COFI have been taken into account in this document, COFI does not necessarily agree with many of the comments contained herein. Interpretations of the biological data cited from the Beak Consultants Ltd. (1989) report were reviewed and approved by the original author.

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1.0 Introduction

The recent report prepared by the pulp and paper sector of the Council of Forest Industries (COFI 1990) provides an excellent description of the B.C. Pulp and Paper industry and its importance to the provincial economy. It is, nonetheless, a document of debatable technical merit. The selective use of observations from source material, the omission of certain facts about issues raised in the paper, and a general lack of detail about assumptions used to calculate the estimated cost of adopting environmental controls, together, raise concern about credibility of the report.

The review undertaken herein is divided into three areas. First, general comments made by COFI that are of questionable validity, are examined for accuracy and consistency. Second, the original sources cited to support less restrictive organochlorine controls (2.5 kg AOX/tonne) are reviewed and compared with statements appearing in the COFI document. Third, the cost estimates for environmental controls are examined on the basis of other studies and analyses undertaken to assess the industry's ability to treat and control effluent discharges. The arguments used by COFI to defend the position adopted in the paper (2.5 kg AOX/t) depend on the interpretations applied by COFI to the work of others (referenced in the COFI document). As a result, it is not possible to accurately convey the seriousness of the flaws within the COFI paper, unless citations from the source documents are used to substantiate the criticisms presented here.

2.0 Accuracy and Consistency

There are many statements in the COFI paper which in our opinion could convey inaccurate impressions.

2.1 COFI Statement on Pollution Control Investment

The discussion in the first paragraph of P.6 refers to the annual investment necessary for the B.C. Pulp and Paper industry to remain competitive in international markets. It is noted that "During the decade of the 1980's, in spite of severe recession, the forest products industry invested $10 billion in capital improvements". Later on P.8, it is stated that B.C. mills spent "over $430 million on air and water pollution controls between 1960 and 1986...B.C. companies will spend more than $450 million on environmental controls, representing some 28 percent of its capital expenditures."

Commentary

Even though the 28 % of total capital expenditure for 1990 may seem impressive, it should be noted that part of this cost is associated with items only marginally associated with organochlorine control

(See Section 4: Cost Estimates for Environmental Control). To illustrate the industry's commitment to pollution control, the 1990 expenditures should be compared to the pattern of industry's pollution expenditures over time. The expenditure of $430 million on air and water pollution abatement for the period 1960 to 1986 (26 years) represents only 4.2 percent total capital expenditures in the forest products industry during the period 1980 to 1989 (9 years), and would be even a smaller percentage of the total capital investment if the 26 year period were considered. The average investment on pollution controls as a percentage of total capital investment in all of the Canadian industry ranged from a high of 19 percent in 1975 to a low of 6.6 percent in 1985 over the period 1971 to 1985 (Sinclair 1990:224). Pulp mills in B.C. (according to the figures presented in the COFI paper) have invested a much smaller percentage of their total capital investment on pollution than mills elsewhere in Canada.

Information recently compiled as part of an informal (non-scientific) survey, and published by the provincial Ministry of Regional Development indicates that total committed or planned capital investment by the industry in British Columbia over the next three years is $5.25 billion (British Columbia Major Projects Inventory, September 30, 1989). According to this same document $494.2 million (or 9.4 percent of total capital investment) is planned for pollution controls. The recorded total capital investment takes place over a period up to 1994 and not during the single year 1990 as claimed by COFI (P.8). The investment of pollution controls does not represent 28 percent of total capital investment as claimed in the report (P.8), but only 9.4 percent and even this estimate probably overestimates expenditures on pollution controls because of the difficulties associated with identifying capital equipment purchased mainly for this purpose.

2.2 COFI Statement on Effluent Quality

On P.7, it is stated that since the 1950's, BOD and TSS have been significantly reduced by 29 and 61 percent, respectively, while production volumes have more than tripled.

Commentary

Aside from the fact that BOD and TSS discharge information during the 1950's and 1960's is often unavailable, and what is available is often suspect, this observation ignores that total toxicity discharges from B.C. mills continually increased over the period 1971 to 1985. It fails to recognize the impact that effluent discharges have on the environment (Colodey et al. 1991), and the generally very poor performance of B.C. coastal mills, when compared to the remainder of mills in B.C. and the rest of Canada (Sinclair 1990:157 and 158).

2.3 COFI Statement on Pollution Control Objectives

On P.12 of the COFI paper, it is stated that "The Pollution Control Objectives define level A and level B effluent standards. Level A standards apply to pulp mills constructed since the mid 1960's in the B.C. interior. These standards are more stringent than level B's standard, which apply in most cases to older coastal mills". Later on the same page, it is stated "With some exceptions, interior mills meet level A effluent standards and coastal mills are basically in compliance with level B standards for TSS and BOD". Down further on the same page, it is stated "pulp mill compliance in B.C. has been further confused by comparisons with federal standards, which are in the process of being updated". Then on the second last paragraph of the page, it is stated "The past comparison of level B mills with federal standards for new mills leaves the erroneous impression that these older mills are violating federal pollution regulations. In fact, mill permits are issued by the provincial government".

Commentary

COFI omitted acknowledging that 14 of the 23 (two mills in Prince George use the same pollution control systems) mills in B.C. are not in compliance with the waste management permits issued by the province (announced in a statement by the Deputy Minister of the Environment for the province on May 7, 1990). Federal regulations were established in 1971. The standards used in the federal regulations were formulated in conjunction with representatives of industry to provide minimal national standards. Despite the 19 years that government standards have been in place more than half the mills in the province are in violation of provincial regulations, and an even greater portion would be in violation of federal regulations if they applied and were rigorously enforced (see Sinclair 1988:103-111). According to COFI, the latest provincial non-compliance data (November 1990) indicate that 9 of 23 mills are out of compliance.

2.4 COFI Statement on "State of the Art" Organochlorine Emissions

At the bottom P.12 and the top of P.13, it is stated "Organochlorine emissions will be significantly reduced and the quality of mill effluent will compare favourably with 'state of the art' pulp mills throughout the world". Later on P.22, it is stated "The 2.5 kg AOX/tonne limit matches the requirement announced by the Ontario Ministry of Environment in April 1989. The 1.5 kg/tonne is similar to limits enacted in Sweden which are based largely on the emerging capability of technology to control organochlorines".

Commentary

These statements allege that 2.5 kg AOX/tonne compares favourably with the state of the art standard for the industry throughout the world. It further states that the 1.5 kg AOX/tonne is an emerging technology. However, this is at odds with recent initiatives for at least one mill in Canada and the perception and practises of environmental agencies in the United States. The E.B. Eddy Mill in Espanola, Ontario consistently maintains a 1.0 to 1.1 kg AOX/tonne for their facility. Not one pulp mill permit has been issued in EPA Area X (Alaska, Idaho, Washington and Oregon) during the past year which allows the discharge of organochlorine to exceed 1.5 kg AOX/tonne. At least three mills in Oregon and two mills in Washington state have been issued permits by the state requiring an annual average AOX of 1.5 kg/tonne. In Idaho, where the State Government does not have the authority to issue pulp mill permits under the National Pollutant Discharge Elimination System (NPDES), EPA under the authority of the Clean Water Act has issued a permit requiring an average annual AOX of 1.5 kg/tonne.

Recent evidence by Ahlstrom and Kamyr Inc. (1990) and Basta et al. (1990:160) indicate that AOX values of less than 1 kg AOX/tonne are achievable prior to secondary treatment. According to these sources and others (Bonsor et al. 1988:5-88) secondary treatment can provide a further 30 percent reduction in organochlorine discharge. The proposed ALPAC mill is expected to have AOX loadings of 0.25 kg AOX/tonne (ALPAC 1990). On the basis of these observations, 2.5 kg AOX/tonne cannot be considered state of the art for mills throughout the world.

2.5 COFI Statement on Harmful Effects of Dioxins

On P.16, it is stated that "Whenever medical evidence of damage to human health exists, the setting of safety standards and priorities to address the threat is a relatively straight forward matter. The problem of determining reasonable standards becomes more complicated in cases where toxic substances are present in extremely low quantities and evidence of health and environmental effects is indirect or unavailable". Later in the next paragraph "During the second half of the 1980's, public concern was aroused by the discovery of minute (trace) quantities of dioxins found in pulp mill effluent streams. The discovery of these previously undetected compounds resulted directly from the rapid development of increasingly sensitive analytical measuring devices".

Commentary

These statements suggest that the discovery of minute quantities of dioxins brought about by the decline in detection limits led to unjustified public concern. It also implies that there is no scientific evidence to indicate that there is a threat to human health or harmful effects on the environment as a result of the

small concentrations of dioxins and furans found in pulp mill effluent streams. Although the evidence as to the concentrations necessary to threaten human health is admittedly perplexing, contaminated biota have led to fisheries closures and advisories which have limited resource use in many areas adjacent to B.C. pulp mills. The threat to the environment is documented. It should be recalled that dioxins and furans were assessed and deemed "toxic" as defined under Section 11 of the Canadian Environmental Protection Act (Boddington et al. 1990). An example of the toxicity of dioxins in minute quantities was demonstrated in the laboratory study by Mehrle et al. 1988. It was found that less than 38 parts per quadrillion of dioxin caused delayed mortalities and changes in growth and behaviour in rainbow trout. This study was not mentioned in the COFI report, nor was any information given with regard to the aquatic toxicity of dioxins. Further biological effects include changes in fish health and are described in the following section.

The COFI report gives the impression that the public was unjustly "aroused" by the detection of dioxins brought about by declining detection limits, and that there is little scientific evidence to suggest that minute levels of dioxins and furans pose a threat to the environment. We commend the pulp and paper industry for their efforts related to the rapid identification and control of dioxins and furans in pulp mill effluent, but we do not support the viewpoint presented by the COFI report.

3.0 The Sources Cited to Support Less Restrictive Organochlorine Controls

One of the two major opinions expressed in the COFI document can best be summarized by the following:

> Based on the findings of a review of available information carried out by the Pulp and Paper Research Institute of Canada (PAPRICAN) and other related sources, the industry recommends that government regulators establish a pulp mill discharge standard of 2.5 kg AOX/tonne unless further scientific research reveals new evidence to suggest further reduction. (p.4).

According to COFI (P.11), the conclusions are based on the following studies and reviews:

1. Literature review by Procter and Gamble (1989)
2. NCASI artificial stream studies (NCASI 1983, 1989)
3. PAPRICAN report (Fleming et al. 1990)

3.1 COFI Use of the Procter and Gamble Report

The COFI document cites the Procter and Gamble report on P.11 to

say that there is no solid evidence to link environmental damage to organochlorine emissions.

Commentary

COFI neglects to point out that the authors further added this note of caution: "However, there is a great deal of uncertainty associated with this position, and we recommend a judicious approach be taken when considering the impacts of either bleached or unbleached effluents on aquatic ecosystems" (Procter and Gamble 1989:22). On P.19 of this same document, it was noted that although fish may be contaminated with dioxins and furans, "no adverse effects on fish have been reported in field studies". It is further noted that there are "a lack of comprehensive studies conducted to ascertain environmental effects".

An observation made in the Procter and Gamble Report which might be interpreted as supportive of the COFI position is that chlorinated organics are not conclusively implicated as the "single causative factor for observed impacts" (Procter and Gamble 1989:1). If COFI is using this observation to support the view that there is no scientific evidence linking organochlorines to environmental damage, then it should be noted that it is uncommon in any field study to have a single parameter identified as the only causative factor for tested observations. Laboratory results which link exposure to effluent organochlorine compounds with biological effects include the following: Renberg et al. 1980, Cherr et al. 1987, Bacon 1980, Lindstrom-Seppa and Oikari 1989a, Neilson et al. 1984, Neilson 1989). Field and lab studies also have been used to link mill effluent exposure to liver damage and metabolic changes, enzyme induction and in some cases reduced steroid hormone levels and morphological and physiological changes (AEC 1987, Andersson et al. 1988, Lindstrom-Seppa and Oikari 1989b & 1990, Munkittrick et al. 1989, Rogers et al. 1989, Hodson et al. 1990, Servizi et al. 1990).

Laboratory studies have also demonstrated the adverse effects of dioxins on fish: mortalities, growth and behaviour changes (Mehrle et al. 1988), increased numbers of lesions following viral exposure (Spitsbergen et al. 1988), and increased liver enzyme activation and lower plasma testosterone levels (Lindstrom-Seppa and Oikari 1989). Marine crabs fed dioxin and furan contaminated clams had fewer moults and slower limb regeneration (Cristini et al. 1989). It has been shown in other laboratory studies that Great Blue heron eggs contaminated with higher levels of dioxins exhibited reduced growth, edema, liver enzyme (EROD) activation as well as other morphological and physiological changes (Hart et al. 1990, Bellward et al. 1990).

The Procter and Gamble report recommended a cautious approach when considering the biological impact of pulp and paper effluents. The environmental impacts of even conventional parameters like BOD and

TSS are modified by in-plant, treatment and local receiving water conditions. Effluent limits based on a per tonne of mill production (e.g. AOX=2.5 kg/t) would not necessarily ensure environmental protection. Accordingly, the Procter and Gamble report recommended a site-specific approach combining the use of laboratory and field assessments into an integrated assessment. They also stated that generic measurements related to the organically bound chlorine in effluent (like AOX) do not provide any indication of the potential impact, toxicity, fate and persistence of organochlorine compounds, but do provide indices of total organochlorine concentration and the bioaccumulation of organochlorine compounds.

When taken in context of the above comments, the Procter and Gamble report cannot be used to support COFI's claim that 2.5 kg AOX/tonne will always provide adequate protection to the environment.

3.2 COFI Use of NCASI Artificial Stream Channel Studies

According to COFI (p.11), the PAPRICAN review, the Procter and Gamble Report (discussed above), and the American National Council of the Paper Industry for Air and Stream Improvement (NCASI) stream studies indicated that "...no deleterious effects were detected..." on fish exposed to treated bleached kraft mill effluent.

Commentary

The NCASI reports are often cited by industry in an attempt to support this claim. The NCASI studies did show enhanced growth of macroinvertebrates (due to nutrient enrichment) and of exposed trout (due to lower densities). However, the NCASI artificial stream studies also demonstrated statistically significant lower survival of exposed rainbow trout, compared to control fish, in 4 of 5 experiments (NCASI 1989:97). These effluents received 14 days of secondary treatment, and acute toxicity was not responsible for the reduced survival of effluent-exposed fish (NCASI 1989:98). The deleterious effects of the mill effluent are further demonstrated when the mountain whitefish results are examined. Effluent exposed streams were colonised by fewer mountain whitefish (n=8,9) compared to control streams (n=58, 20), and produced lower total biomass of mountain whitefish than the streams which received no pulp mill effluent (NCASI 1989:108). Although trout successfully spawned in effluent-exposed channels, there were fewer fry produced due to increased mortalities compared to streams which only received river water (NCASI 1989 p.113). Thus, NCASI research does not conclusively support the claim by COFI on P.11 that well-treated bleached kraft mill effluent causes no deleterious effects.

3.3 COFI Use of the PAPRICAN Report to Support AOX=2.5

On P.10 of the COFI report it is stated that the main conclusion of the PAPRICAN report is that the release of 2.5 kg AOX per tonne of

pulp provides satisfactory protection of the environment.

Commentary

This conclusion by PAPRICAN is based on NCASI studies where effluents contained organochlorine levels of 3 to 4 kg AOX/tonne and Procter and Gamble report (discussed above). PAPRICAN further cites the Beak Consultants Ltd. (1989) study on the Dryden mill and concludes that with an AOX of 3.8 kg/tonne the effluent was non-toxic. It is further noted that the Dryden mill effluent would not cause sub-lethal effects when diluted 1:1 with river water. In direct contradiction to this, data in the Beak report on the Dryden mill shows that only 27% of the bioassays conducted between 1984 and 1988 were non-lethal, and that 17 % of the tests indicated that lethal conditions would exist outside a 1:1 dilution zone. Furthermore, the Beak study predicted periodic sublethal growth effects in fish for more than 70 km downstream, based on sublethal fathead minnow bioassay results and worst-case conditions of low-flow and high effluent toxicity. Walleye collected downstream were smaller than upstream fish of the same age class (3+) based on the very limited samples collected (n=6), however it should be noted that the downstream fishery showed "no outward sign of impairment that could be attributed to" mill operations.

Data in the Beak report also show the presence of organochlorine contamination in water, sediment, and biota 70 km downstream from the Dryden mill. However, the impact of mill effluent on the benthic community (reduced diversity) was likely related to the effects of organic enrichment rather than any effect that may have been attributed to AOX or EOX.

PAPRICAN and COFI rely on an AOX level of 2.5 kg/tonne to provide environmental protection from organochlorines, yet the Beak report found no correlation between AOX and toxicity nor AOX and chlorophenol species measured.

3.4 COFI and Pentachlorophenol Toxicity Equivalent Units (TEU)

The COFI report on P.11 supports the use of the concept of pentachlorophenol toxicity equivalence units (TEU) reported in the PAPRICAN document.

Commentary

PAPRICAN supports the notion that toxicity equivalence units can be derived for chlorophenols. This is a theoretical justification for claiming that AOX limits of 2.5 kg/t would ensure environmental protection. The TEU concept only takes into account lethal and sublethal effects related to chlorophenol species. These compounds

are not always found to be correlated to toxicity even in laboratory bioassays (e.g. Salkinoja-Salonen et al. 1981, Beak Consultants Ltd. 1989:7.1).

Another erroneous assumption related to the toxic equivalent unit is that higher chlorinated chlorophenols are always more toxic or harmful to the environment than less chlorinated forms. Although this is generally true, it can be shown that the toxic equivalent unit concept of PAPRICAN underestimates the potential environmental significance of 2,4-dichlorophenol by a factor of 200 when the tainting capacity is taken into account (CCREM 1987).

At least one recent field study undertaken in Ontario provides evidence that 2.5 kg AOX/tonne does not ensure adequate protection of the environment. Work by Munkittrick et al. 1989 at Terrace Bay showed decreased growth rates, metabolic and reproduction damage in male and female white sucker as a result of exposure to mill effluent loadings of 2.5 kg AOX/tonne.

The evidence provided by PAPRICAN and used by COFI does not support the assumption that a discharge control limit of 2.5 kg AOX/tonne adequately protects the environment.

4.0 Cost Estimates for Environmental Controls

On P.3 of the COFI report, it is stated:

> The industry has committed to reducing organochlorine levels to 2.5 kg AOX/tonne at a cost of over $1 billion. However, further reduction to 1.5 kg/tonne would add another $600 million. Attaining level A air objectives has been estimated at over $550 million. In addition, other emerging air objectives and a range of special waste issues are anticipated to approach $1 billion.

Commentary

Although the term "estimate" is used in conjunction with the claimed capital expenditure costs, so also is the term "emerging". This together with the subsequent observation that "unless further scientific research reveals new evidence to justify a further reduction" (P.4), suggests that the industry is committing enormous amounts of money to protect the environment from imaginary impacts. The COFI report goes on to describe the importance of the industry to the B.C. economy, indicate that the industry must compete in international markets (P.5), and note that the pollution control expenditure estimates during 1990 will represent 28 percent of capital investments within the industry during that single year. Not only do these expenditure claims greatly exceed other capital cost estimates done for the industry, but the way in which the cost estimates are presented is inappropriate.

One of the most difficult problems encountered when estimating the amount actually invested on pollution controls is determining what portion of investment is necessary to protect the environment. Modern equipment and new technologies practically always are more efficient than the equipment and technologies being replaced and as a result are usually environmentally cleaner. Production or processing phases are linked so that the introduction of a new piece of equipment may result in the need for some adjustment or modifications throughout the production system. Therefore, it is not unusual for industry to overestimate the actual amount spent on pollution controls. Yet COFI in its presentation provided no breakdown on its estimates. They do not identify the equipment that will be used or the assumptions made in calculating their estimates. The industry has committed to installing biological treatment systems (to meet Level A toxicity standards), and some within the industry have already committed to adopt the latest technology to control organochlorines to 1.5 kg AOX/tonne (e.g. Port Mellon). The inclusion of these costs in the estimates provided is unwarranted and misleading unless specifically identified. A detailed examination of the cost estimates presented by COFI for the control of organochlorines appears to include expenditures already committed to by the industry as well as the cost of new washers (which are only marginally related to the control of organochlorines).

The only true indication of the impact that environmental controls will have on the industry is through the assessment of production costs. There are operating cost savings associated with adopting the controls necessary to meet 1.5 kg AOX/ tonne. It has been estimated that the chemical cost savings for mills on the high end of the chemical consumption spectrum in Ontario would be between $11 and $12 per tonne of production. Among mills on the lower end of the chemical cost spectrum, the net savings in chemical costs for Ontario mills would be around $10 per tonne (Bonsor et al. 1988:12-211). For B.C. mills these cost savings have been estimated to range between $2.2 and $5.5 million per year (N. McCubbin Consultants Inc. 1990), depending on the combination of treatment and control systems employed. Although these operating savings will not necessarily generate full cost recovery for the industry, they are significant and greatly alter the economic consequences of investing on controls.

Cost estimates calculated internally (DOE) during the fall of 1988, indicate that with one exception, the highest cost mills in B.C. could meet the 1.5 kg AOX/tonne requirement at a capital cost of $50 million or less and an additional operating cost of about $6.00 per tonne of production output. When the very high costs for these few mills are attributed to all 17 mills in B.C. requiring AOX controls, the total cost to the industry in B.C. would not exceed $850 million. A more detailed examination of the costs of meeting 1.5 kg AOX/tonne by McCubbin in 1990, indicates that it would cost coastal B.C. mills $510 million and interior mills $66 million.

According to McCubbin in the median to high capital cost ranges (Nystrom et al. 1990:45-52) most B.C. mills would actually benefit from adopting the controls to meet 1.5 kg AOX/tonne rather than the 2.5 kg AOX/tonne. The cost estimates provided above, although for the most part conservative and high, are considerably less than the $1.6 billion estimate provided by COFI (cited above).

On P.41 of the COFI document it is noted that "over-capacity, high interest rates, the related exchange rate problem of a relatively strong Canadian dollar, high wood fibre costs, and international recycled newsprint content regulations will all have a dampening effect on industry earnings". This observation is followed by the statement that "The cost of new, proposed and emerging environmental protection programs is estimated to range between two and three billion dollars" on P.42. Not only are the estimates of two to three billion dollars not explained, they are high. The problems facing the industry as a result of over-expansion are well known to all involved in the industry and have been reported in the media as well as in trade magazines for the past two years. The industry was aware of the environmental problems facing them two years ago. It can be argued they chose to ignore pollution requirements by spending their record high profits on expansions that they knew would further exacerbate the already serious problem of excess capacity apparent at that time (Sinclair 1990:271-272).

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