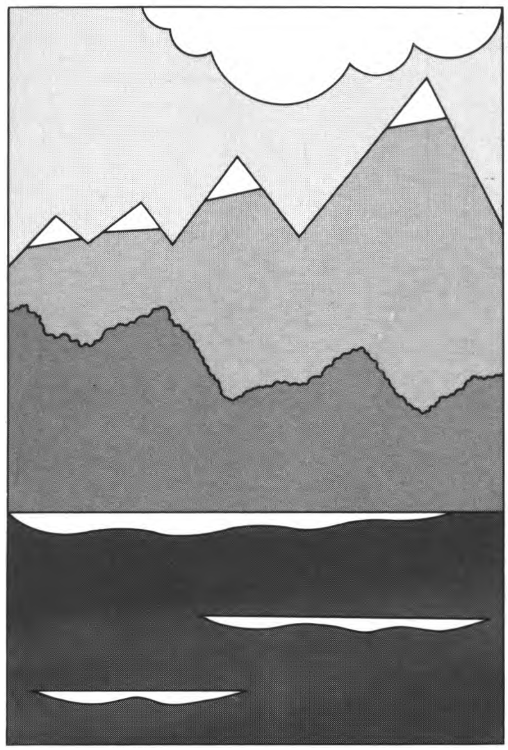
# Alberta Environment's Response





**Submission to the**
**Alberta-Pacific Environmental**
**Impact Assessment Review Board**

**January 15, 1990**

Alberta
ENVIRONMENT

# ALBERTA ENVIRONMENT'S RESPONSE

**Submission to the**
**Alberta-Pacific Environmental**
**Impact Assessment Review Board**
**January 15, 1990**

Alberta
ENVIRONMENT

Office of the Deputy Minister

14th Floor, Oxbridge Place, 9820 - 106 Street, Edmonton, Alberta, Canada T5K 2J6 403/427-6236

January 15, 1990

Mr. G.J. DeSorcy
Chairman
Alberta-Pacific Environmental
Impact Assessment Review Board
15th Floor, Standard Life Centre
10405 Jasper Avenue
EDMONTON, AB
T5J 3N4

Dear Mr. DeSorcy:

I am pleased to submit 12 copies of Alberta Environment's response to undertakings arising from presentations made at the Review Board's hearings during November and December, 1989.

Yours sincerely,

Vance A. MacNichol
DEPUTY MINISTER

Enclosures

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# BIOCHEMICAL OXYGEN DEMAND

Report as requested by Mr. J. Slavik and Mr. G. DeSorcy

Alberta-Pacific Environmental Impact Assessment Review Board Hearing
held at Prosperity on December 14, 1989

Prepared by
Alberta Environment
Standards and Approvals Division

This information was prepared in response to questions from Mr. Jerome Slavik and Mr. Gerry DeSorcy regarding BOD licence limits. (Volume 51, Page 6965, lines 13-19; Page 7016, line 26; Page 7017, lines 1-6; Page 7072, lines 7-25; Page 7073, lines 1-23).

The following tables show BOD loading limits for each mill and total allowable BOD loading on the Athabasca River at various river flows.

## TABLE 1

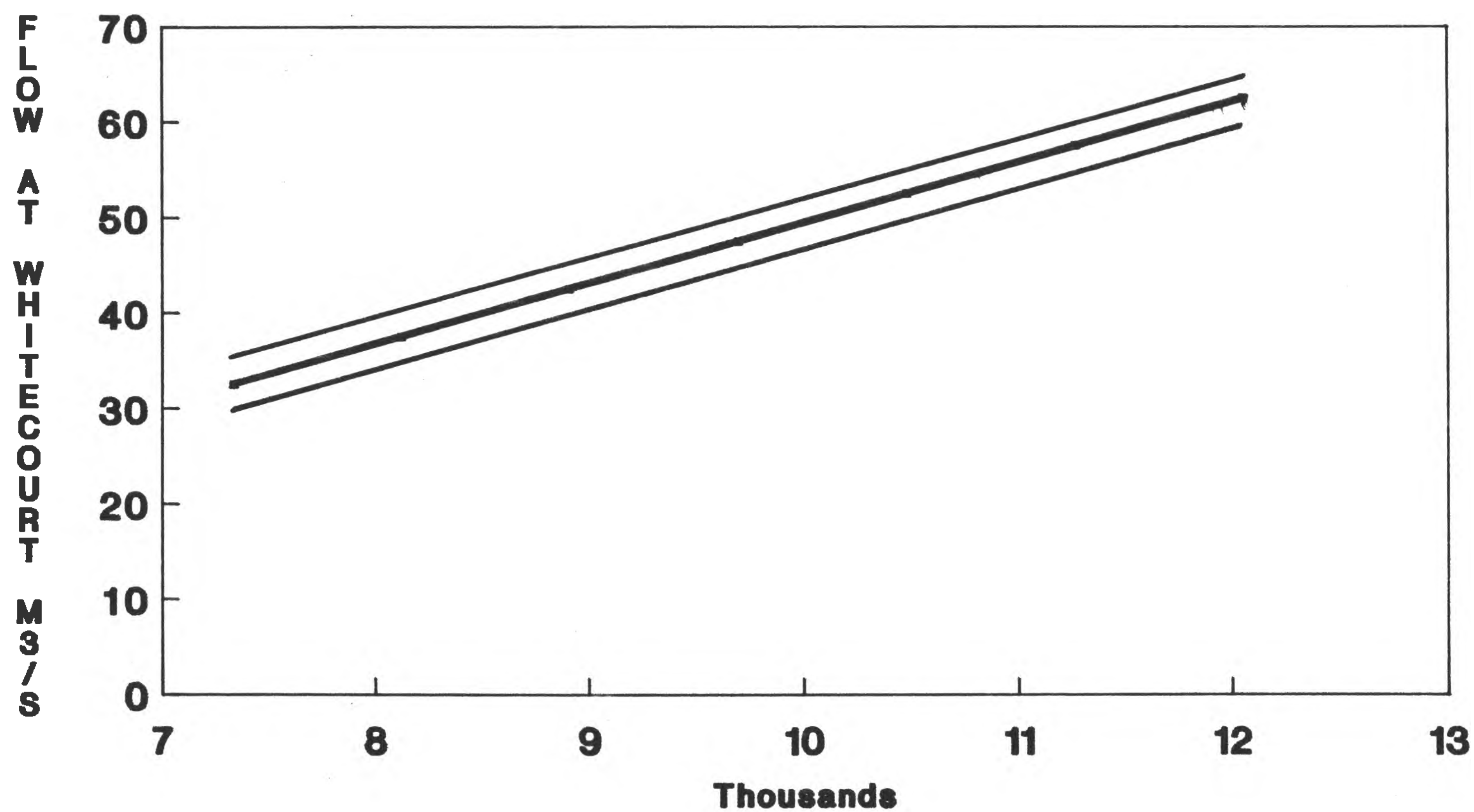
### BOD LOADING Kg/ADMT (Kg/day) monthly average

All Mills, where applicable will have low flow discharge restrictions in effect until they are meeting their long term standards as described below.

| MILL | 1990 | 1991 | 1992 | 1993 |
|---|---|---|---|---|
| WELDWOOD[1] | 7.0 (7700) | 7.0 (7700) | 3.0 (3300) | 3.0 (3300) |
| Alberta Newsprint Company[2] | 3.0 (2100) | 3.0 (2100) | 3.0 (2100) | 3.0 (2100) |
| Millar Western[3] | 7.5 (5100) | 3.0 (2040) | 3.0 (2040) | 3.0 (2040) |
| Alberta Energy Company[4] | | 5.0 (1750) | 5.0 (1750) | 3.0 (1050) |
| Alberta Pacific[5] | | | | 1.5 (2250) |

1. Operating but not yet licensed for expansion
2. Presently Under Construction, August 1990 startup
3. Presently Operating
4. Under Construction, early 1991 startup
5. Proposed mill

## TABLE 2. TOTAL ALLOWABLE BOD LOADING ON THE ATHABASCA R. AT VARIOUS RIVER FLOWS (INCLUDES ALL UPPER BASIN MILLS)




-REQUIRED TO MAINTAIN 5 MG DO/L.
-LOADINGS TO BE ALLOCATED TO WELDWOOD, MILLAR WESTERN, AND ANC.

# POLICY APPROACH AND CRITERIA FOR SETTING ADSORBABLE ORGANIC HALIDES (AOX) IN PERMITS AND LICENCES

Report as requested by Mr. J. Slavik at the

Alberta-Pacific Environmental Impact Assessment Review Board Hearing
held at Prosperity on December 14, 1989

Prepared by

Alberta Environment
Standards and Approvals Division

In response to a question by Mr. Jerome Slavik regarding our policy approach and criteria for setting AOX in permits and licences (Volume 51, Page 7017, lines 7-10), we are pleased to enclose a copy of Alberta Environment's 'Policy for In-Plant Control of Adsorbable Organic Halides in Kraft Pulp Mill Effluent'.

POLICY FOR IN-PLANT CONTROL

OF

ADSORBABLE ORGANIC HALIDES

IN

KRAFT PULP MILL EFFLUENT

Hon. Dr. Ian C. Reid
Minister of the Environment

## PRINCIPLES

1. Alberta Environment is to achieve the protection, improvement and wise use of our environment, now and in the future.

2. The goal, with respect to the development of pulp mills, is to ensure that the environment is protected. To achieve this goal, Alberta Environment requires very thorough environmental evaluations prior to allowing a project to be built. Alberta Environment insists on stringent standards for environmental protection that reflect the best achievable technology for this type of development.

## ENVIRONMENT PROTECTION STANDARDS

3. Alberta will require its pulp and paper industry to implement environmental standards which are reflective of "leading edge technology." The standards are designed to put Alberta mills amongst world leaders in controlling the production of dioxins and other chlorinated organic compounds, and in minimizing the release of these compounds into the environment. Our goal is to reduce dioxins to an absolute minimum or eliminate them if possible.

4. Alberta will be requiring expanding or new mills to incorporate all the latest technologies including extended delignification, oxygen delignification and chlorine dioxide substitution in the first chlorine stage of bleaching. The bleaching process creates organic halogens, specifically dioxins, and the Alberta standards are designed to minimize or eliminate these priority pollutants.

5. Our standards will regulate pulp mills to the best achievable levels possible, and will be among the most stringent international standards. Adsorbable organic halides (AOX) will be specifically regulated in Alberta. Existing mills in Alberta will also be required to incorporate best achievable technologies to reduce AOX. Industries will be expected to demonstrate how technology selection, and procedures, optimize operations so as to achieve the minimum overall level of AOX released.

6. Alberta will have multilevel standards for pulp mills. These are annual performance, monthly performance, daily and where necessary, impact level performance standards.

7. Alberta Environment sets specific effluent standards for pulp mills to protect the environment. Standards are set for: biological oxygen demand, total suspended solids, color, dissolved oxygen, pH, resin acids, acute toxicity, and adsorbable organic halides.

## NEW TECHNOLOGY TO REDUCE DIOXIN FORMATION AT KRAFT MILLS

8. As a matter of policy, Alberta Environment will require kraft pulp mills in Alberta to incorporate new technologies to minimize or eliminate the release to the environment of adsorbable organic halides (AOX) including organic halogens such as dioxin and furans.

9. Best achievable in-mill technology must be installed at expanding and new mills. The following is believed to represent best achievable in-plant control technology at this time, but other technologies that minimize or eliminate the release of AOX will be required as they become available.

### Extended Delignification

The digester (cooker) is capable of partially removing the lignins from the wood chips, and the term extended delignification refers to the additional capability of the digester to remove a greater amount of lignins than the conventional digester.

### Oxygen Delignification

Oxygen delignification provides an additional step between extended delignification and conventional bleaching where lignins can be further removed. The benefit of this process is to minimize the amount of lignins carried over in the pulp to the chlorine based bleaching sequence, thereby reducing the level of chlorine required for bleaching.

Chorine Dioxide Substitution ($ClO_2$)

In kraft pulp mills, the first stage of bleaching is always a chlorine stage. Due to environmental concerns over chlorinated organic compounds, it is desirable to reduce the amount of free chlorine available to combine with organic compounds. One way of reducing the chlorine use (above and beyond the use of extended delignification and oxygen delignification) is to substitute chlorine dioxide for chlorine in the first stage of the bleaching sequence.

## PERMITS AND LICENCES

10. The Environmental Impact Assessments for new or expanding mills will outline the technologies that will be incorporated to reduce or eliminate the formation of AOX and chlorinated organics. Variation in the release of AOX as a result of wood supply, operating procedures, and products selected by the proponent will be evaluated. Proposed discharges of chlorinated organics will be the subject of specific predictions of environmental impact.

11. Following the successful completion of the EIA process, Alberta Environment will consider an application for a Permit to Construct. The applicant will be required to provide technical details of the processes, their anticipated performance capability, a detailed commissioning procedure and time-frame to obtain optimum performance. If the Director of Standards and Approvals is satisfied that the applicant's proposal meets the intent of this policy and demonstrates that the technology selected and operating procedures optimize operations so as to achieve the minimum level of AOX released, a Permit to Construct will be issued.

12. Prior to the start-up of a mill, the owner must apply for a Licence to Operate. The licence will outline the specific conditions of operation including the standards to be met, the start-up provision, monitoring and reporting requirements. Licences to Operate will be issued for a maximum of five years. The plant will be carefully monitored to ensure compliance throughout this period. Prior to the expiry of a licence, it will be reviewed to ensure that the facilities represent best achievable technology and are being operated according to best practices.

13. In order to obtain the maximum reduction in AOX and chlorinated organics, each mill may have its own standard. The standard will reflect the type of operation and best achievable technology at the time of permitting/licencing.

# INFORMATION ON STATUS OF LANDFILL LOCATED ADJACENT TO PINE SANDS NATURAL AREA

Report as requested by Mr. T. West at the

Alberta-Pacific Environmental Impact Assessment Review Board Hearing
held at Prosperity on November 24, 1989

Prepared by

Alberta Environment
Environmental Assessment Division

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This information was prepared in response to a request by Mr. Ted West regarding the status of the landfill located adjacent to the Pine Sands Natural Area (Volume 31, Page 4090, lines 11-22).

The responsibility for the administration of the Pine Sands Natural Area is vested with Alberta Forestry, Lands and Wildlife. The County of Athabasca is responsible for the operation of municipal landfills within its boundaries. The approving authority for municipal landfills is the Local Board of Health.

The landfill is located in LSD 9, Section 5, Township 69, Range 19 west of the 4th Meridian. The Pine Sands Natural Area was established in 1987 on vacant Crown land. The landfill was excluded from the natural area. There were no records found to indicate when the landfill was approved. Discussions with local residents indicate that the landfill has been in existence for many years. Presumably it predated any approvals which may have been given by the Local Board of Health.

There are two bin dumpsters on the site to accommodate local use. The waste is picked up on a weekly basis.

The Local Board of Health and the County of Athabasca are in the process of evaluating measures to clean up the site.

Information for this response was obtained from the officials in the County of Athabasca and the Department of Forestry, Lands and Wildlife.

0620r

# COMPARISON OF AIR AND WATER EFFLUENT EMISSIONS BETWEEN SYNCRUDE, SUNCOR AND ALBERTA-PACIFIC

Report as requested by Mr. R. Ewashko at the

Alberta-Pacific Environmental Impact Assessment Review Board Hearing
held at Ft. McMurray on November 25, 1989

Prepared by

**Alberta Environment**
**Standards and Approvals Division**

This information was prepared in response to questions by Mr. Roy Ewashko regarding air and water effluent emissions from Syncrude, Suncor and Alberta-Pacific (Volume 32, Page 4244, lines 20-26; Page 4245, lines 1-23).

A. AIR EMISSIONS

| Parameter | Unit | AlPac[1)] | Suncor[2)] | Syncrude[3)] licenced |
|---|---|---|---|---|
| $SO_2$ | tonnes/day | 15 | 310 | 292 |
| $NO_x$ | tonnes/day | 2.2 | | 50 (main stack) |
| Particulates | $g/m_3$ | 0.10 | 0.23 | 0.23 |

1) Air Quality Impact Assessment, Supplemental Dispersion Modelling for the Proposed Alberta-Pacific Forest Industries Athabasca Kraft Pulp Mill, by Dr. W.A. Murray, Promet, Calgary, October 1989..

2&3) Alberta Environment licences under The Clean Air Act.

B. WATER EFFLUENT

| Parameter | AlPac Proposed [1)] | Suncor[2)] |
|---|---|---|
| TSS | 3.0 kg/Air dry tonne<br>1500 tonnes day: 4,500 kg/day | 16.68 kg/day average<br>243 kg/day maximum |

1) Mill Effluent Treatment System - Activated Sludge Process, October 1989 Stanley Associates Engineering for Alberta-Pacific Forest Industries, Fig.1.

2) Alberta Environment, Standards and Approvals Division, Annual Statistics for Suncor Ltd. 1987. Licenced Limits for Suncor under the Clean Water Act are: average mass discharge per day 1,000 kg and maximum daily mass discharge 1,500 kg.

Syncrude has been subject to a policy of no discharge of process water effluent in the past. Only some brine waters are permitted and the background levels of the receiving stream, Poplar Creek, may not be raised by more than 400 mg/L (chloride concentration).

# ADDITIONAL INFORMATION ON NITROGEN AND PHOSPHORUS IN THE ATHABASCA RIVER SYSTEM AND IN PULP MILL EFFLUENTS

Report as requested by Dr. D. Schindler at the

Alberta-Pacific Environmental Impact Assessment Review Board Hearing
held at Grassland on December 7, 1989

Prepared by

Alberta Environment
Environmental Assessment Division

This information was prepared in response to questions from Dr. David Schindler regarding nitrogen and phosphorus in the Athabasca River (Volume 48, Page 6483, lines 20-23).

## 1.0 INTRODUCTION

The following document contains information on nitrogen and phosphorus in the Athabasca River system and in existing Alberta pulp mill effluents. It is provided in addition to the information entitled "Phosphorus in the Athabasca River System" which was presented to the Alberta-Pacific Environment Impact Assessment Review Board on December 7, 1989. Alberta Environment undertook to provide the enclosed information in response to Dr. Schindler's question "Is the nitrogen to phosphorus ratio in the river such that this increase in P relative to N in loading is likely to cause a species shift in the direction of blue-green [algae]?"

## 2.0 METHODS

As for the phosphorus data supplied earlier, nitrogen data from past sampling were assembled for station(s) at Athabasca and in the Old Fort/Embarras Airport region near the upstream end of the Athabasca Delta. Data for existing Alberta pulp mill final effluents were also compiled. All sampling was done by Alberta Environment or Environment Canada. Due to varying analytical methods and sampling programs over the years, the number of samples and period of record varies for different compounds and stations.

# 3.0 FINDINGS

## 3.1 Athabasca River

Figures 1 and 2 show nitrate-nitrogen (analyzed as nitrate+nitrite) at Athabasca and at Old Fort/Embarras near the head of the Athabasca Delta. Mean nitrate-nitrogen ($NO_3$-N) has been 0.063 mg/L at Athabasca and 0.091 mg/L at Old Fort/Embarras (Table 1) with highest concentrations in winter-spring and lowest concentrations in September-October. Hamilton et al (1985) also noted that $NO_3$-N was lowest towards the end of the open-water season in the Athabasca River.

Ammonia-nitrogen ($NH_3$-N) has averaged 0.026 mg/L at Athabasca and 0.045 mg/L at the Delta (Table 1). The higher concentrations downstream have also been observed by Hamilton et al (1985). Ammonia-N had a similar seasonal pattern to $NO_3$-N but the low concentrations in fall have not been as pronounced (Figures 3 and 4).

Dissolved inorganic nitrogen (DIN), the sum of $NO_2$+$NO_3$+$NH_3$-N, has been compiled and plotted (Table 1 and Figures 5 and 6) since it is a measure of the forms of nitrogen most readily available for uptake and use by aquatic plants. Its seasonal fluctuations were a composite of $NO_3$-N and $NH_3$-N: $NO_2$-N is insignificant.

Total nitrogen (TN) was calculated as the sum of total kjeldahl nitrogen (TKN) + $NO_2$+$NO_3$-N, or in some instances, as the sum of particulate and dissolved nitrogen. Total N averaged 0.828 mg/L at the Delta, almost twice the concentration at Athabasca (Table 1). Hamilton et al. (1985) also observed increasing concentrations downstream. No distinct seasonal pattern in TN concentrations was apparent although the highest values occurred in the open water season (Figures 7 and 8).

Mass transport of nitrogen in the Athabasca River is estimated in Table 2. The mass is much greater at the Delta than at Athabasca, due to greater discharge and secondarily higher concentrations, in the Delta. Transport of DIN has been approximately 10% of TN at both locations.

Nitrogen to phosphorus ratios are of interest in aquatic systems because they can indicate which of these two nutrients may be limiting general plant photosynthesis (Wetzel 1983). As a best approximation, aquatic plants require N and P in a weight ratio of 7:1, thus if N:P departs greatly from this in lake waters on an annual basis, it can indicate which nutrient limits lake trophic status. For the Athabasca River, the ratio of DIN:DP is estimated to be a bit higher than that for TN:TP (Table 3) but both indicate that river water is not greatly different from the theoretical ratio of 7 for plant requirements.

The range of 4.3 to 10 in the ratios (Table 3) probably reflects short-term fluctuations and measurement error. However, the applicability of the TN:TP ratio is uncertain since the bio-availability of particulate N and P is unknown. Much of the TP transport occurs as particulate P in the high flow, open water season and that particulate P may be fairly strongly bound to the high concentrations of inorganic suspended solids.

## 3.2 Pulp Mill Effluents

Nitrogen and phosphorus concentrations in final, treated pulp mill effluent are compiled in Table 4 for Weldwood at Hinton, Millar Western at Whitecourt, and, for comparison, Procter and Gamble at Grande Prairie (on the Wapiti River). Note that Millar Western has been in a start-up mode of operation and the values in Table 4 may not be characteristic of their longer-term effluent.

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Nitrate-N concentrations are not very different from those in the Athabasca River but $NH_3$-N and TKN are higher and during low river flows the mill effluents have caused increases in river concentrations of these variables (Anderson, 1989; Noton & Shaw, 1989). The load of TN and DIN discharged by the Hinton mill is equivalent to about 1% of the estimated mass transport of these variables at the Delta (Table 2), although the fate of effluent nitrogen between Hinton and the Delta is not known.

Of interest is the TN:TP ratio in the mill effluents: for both Weldwood and Procter and Gamble it is remarkably close to 7, the theoretical requirement for aquatic plants. The DIN:DP at Weldwood was 5.7, not greatly different than this. These ratios may partly reflect the nutrient supplementation practices in wastewater treatment at both mills. If no specific treatment to control nutrients is undertaken at the mills, it seems reasonable to assume this ratio will be similar in the future.

## 4.0 CONCLUSION

In the Athabasca River, N and P appear to be present in about the same ratio as that required by aquatic plants. However, the bio-availability of the particulate fractions of the N and P in the river water has not been investigated. Both nutrients are higher in concentration in pulp mill effluents than in the river, but in the effluents they are also present in a ratio of approximately 7. This implies that pulp mill effluent discharges may not alter the N:P ratios in the river.

In answer to the question posed for this undertaking (Section 1), it does not appear that total P will increase relative to total N as a result of pulp mill effluents. However, there might be changes in bio-available forms and ratios of these nutrients since it seems reasonable to assume that the TN and TP in pulp mill effluent is more bio-available than is the TN and TP in the river. This uncertainty will be addressed by future environmental monitoring.

U.C. LITERATURE CITED

Anderson, A.M. 1989. An assessment of the effects of the combined pulp mill and municipal effluents at Hinton on the water quality and zoobenthos of the Athabasca River. Environmental Quality Monitoring Branch, Alberta Environment. 205 pp.

Hamilton, H.R., M.V. Thompson, and L. Corkum. 1985. Water quality overview of the Athabasca River Basin. Prep. for Planning Div., Alberta Environment by Nanuk Engineering Ltd. 117 pp. + Appendix.

Noton, L.R. and R.D. Shaw, 1989. Winter water quality in the Athabasca River system 1988 and 1989. Environmental Quality Monitoring Branch, Alberta Environment. 200 pp.

Wetzel, R.G. 1983. Limnology. 2nd ed. Saunders College Publishing. Toronto. 767 pp.

Table 1. Nitrogen Concentrations in the Athabasca River

| Statistic | $NO_2+NO_3$ N mg/L | $NH_3$ N mg/L | Diss. Inorganic N (calc.) mg/L | Total N (calc.) mg/L |
|---|---|---|---|---|
| Athabasca R. at Athabasca | 1974-88 | 1987-88 | 1987-88 | 1974-88 |
| n | 145 | 22 | 22 | 142 |
| Min. | 0.002 | <0.01 | | |
| Percentiles - 10th | 0.005 | 0.010 | | |
| - 25th | 0.005 | 0.010 | | |
| Median - 50th | 0.040 | 0.020 | 0.06 | 0.365 |
| - 75th | 0.100 | 0.030 | | |
| - 90th | 0.140 | 0.060 | | |
| Max. | 0.400 | 0.120 | | |
| Mean | 0.063 | 0.026 | 0.089 | 0.451 |
| Std. Deviation | 0.071 | 0.027 | | |
| Athabasca R. at Old Fort/Embarras | 1977-88 | 1977-88 | 1977-88 | 1977-88 |
| n | 69 | 68 | 68 | 52 |
| Min. | 0.002 | 0.001 | | |
| Percentiles - 10th | 0.002 | 0.008 | | |
| - 25th | 0.010 | 0.018 | | |
| Median - 50th | 0.045 | 0.031 | 0.084 | 0.422 |
| - 75th | 0.160 | 0.064 | | |
| - 90th | 0.240 | 0.100 | | |
| Max. | 0.475 | 0.250 | | |
| Mean | 0.091 | 0.045 | 0.137 | 0.828 |
| Std. Deviation | 0.102 | 0.042 | | |

Record includes the Hinton pulp mill but pre-dates the Whitecourt pulp mill.
Values less than detection assumed to be 1/2 detection limit.

Table 2. Estimated Nitrogen Mass Transport in the Athabasca River (mean kg/d)

| | at Athabasca | | at Old Fort/Embarras | |
|---|---|---|---|---|
| | Diss. Inorganic N 1987-88 | Total N 1974-88 | Diss. Inorganic N 1977-88 | Total N 1977-88 |
| January | 840 | 3,500 | 4,400 | 14,000 |
| February | 910 | 3,600 | 4,500 | 13,000 |
| March | 1,300 | 3,800 | 4,000 | 13,000 |
| April | (11,000) | 29,000 | 4,400 | 55,000 |
| May | 1,200 | 29,000 | 3,100 | 46,000 |
| June | 5,800 | 46,000 | 9,900 | 223,000 |
| July | 4,800 | 60,000 | 18,000 | 97,000 |
| August | 2,800 | 29,000 | 5,500 | 120,000 |
| September | 350 | 23,000 | 2,000 | 50,000 |
| October | 220 | 10,000 | 2,000 | 75,000 |
| November | 280 | 5,300 | 2,300 | 28,000 |
| December | 550 | 4,300 | 2,500 | 28,000 |
| Annual Mean | 2,500 | 21,000 | 5,200 | 63,000 |

Note: Record includes the Hinton pulp mill, pre-dates the Whitecourt pulp mill.
( ) - low sample size

Table 3. Nitrogen - Phosphorus Ratios, Athabasca River

| | at Athabasca | | at Old Fort/Embarras | |
|---|---|---|---|---|
| | DIN:DP | TN:TP | DIN:DP | TN:TP |
| April | (23) | 4.6 | 13 | 22 |
| May | 2.3 | 5.2 | 3.9 | 6.0 |
| June | 12 | 3.1 | 5.5 | 5.7 |
| July | 7.1 | 3.5 | 12 | 2.5 |
| August | 6.5 | 4.6 | 11 | 8.0 |
| September | 1.7 | 3.4 | 5.6 | 14 |
| October | 1.2 | 12 | 9.1 | 27 |
| Annual Mean | 8.9 | 4.3 | 10 | 6.6 |

( ) - low sample size

Table 4. Nitrogen and Phosphorus in Alberta Pulp Mill Effluents

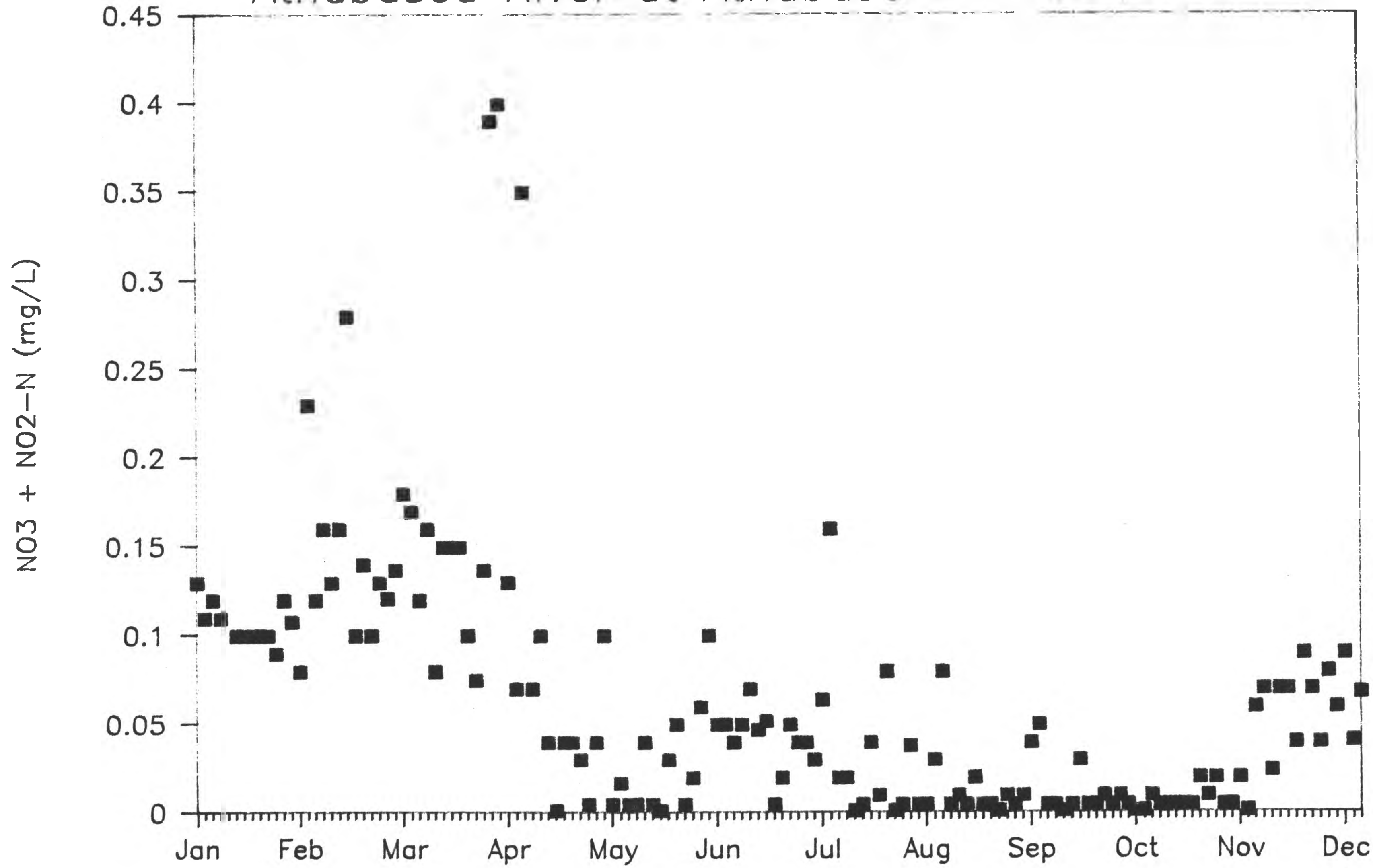
| | $NO_2+NO_3$ N | $NH_3$ N | Total Kjeldahl N | Diss. Inorganic N (calc.) | Total N (calc.) | Diss. P | Total P |
|---|---|---|---|---|---|---|---|
| **Weldwood of Canada** | | | | | | | |
| Final Effluent Composite 1980-89 | | | | | | | |
| n | 36 | 34 | 33 | 34 | 33 | 9 | 35 |
| Min. | <0.003 | 0.012 | 1.50 | | | 0.060 | 0.350 |
| Max. | 0.71 | 3.54 | 15.2 | | | 0.450 | 2.30 |
| Mean | 0.107 | 0.996 | 6.01 | 1.103 | 6.217 | 0.192 | 0.894 |
| Std. Deviation | 0.157 | 0.717 | 2.98 | | | 0.116 | 0.321 |
| Ratios: | DIN:DP = 5.7 | | TN:TP = 7.0 | | | | |
| ***Millar Western Pulp** | | | | | | | |
| Final Effluent Composite 1988-89 | | | | | | | |
| n | 7 | 7 | 7 | 7 | 7 | 5 | 6 |
| Min. | 0.020 | 0.015 | 11.5 | | | 2.45 | 4.0 |
| Max. | 0.100 | 1.08 | 56.0 | | | 20.8 | 34.0 |
| Mean | 0.048 | 0.220 | 30.8 | 0.268 | 30.8 | 8.15 | 13.7 |
| Std. Deviation | 0.036 | 0.380 | 20.1 | | | 7.35 | 10.7 |
| **Procter and Gamble** | | | | | | | |
| Final Effluent Composite 1988-89 | | | | | | | |
| n | 34 | 28 | 28 | 28 | 28 | NA | 28 |
| Min. | <0.020 | 0.011 | 0.75 | | | | 0.31 |
| Max. | 0.64 | 3.44 | 29.4 | | | | 2.85 |
| Mean | 0.136 | 0.296 | 9.15 | 0.432 | 9.29 | | 1.33 |
| Std. Deviation | 0.126 | 0.647 | 7.62 | | | | 0.75 |
| Ratios: | DIN:DP = NA | | TN:TP = 7.0 | | | | |

* Start-up mode of operation

Results as mg/L

Figure 1. **Nitrogen - Nitrate + Nitrite**

Athabasca River at Athabasca 1974-1988

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Environmental Assessment Division
Environmental Quality Monitoring Branch

Figure 2.

# Nitrogen - Nitrate + Nitrite

## Athabasca River at Old Fort/Embarras 1977-1988

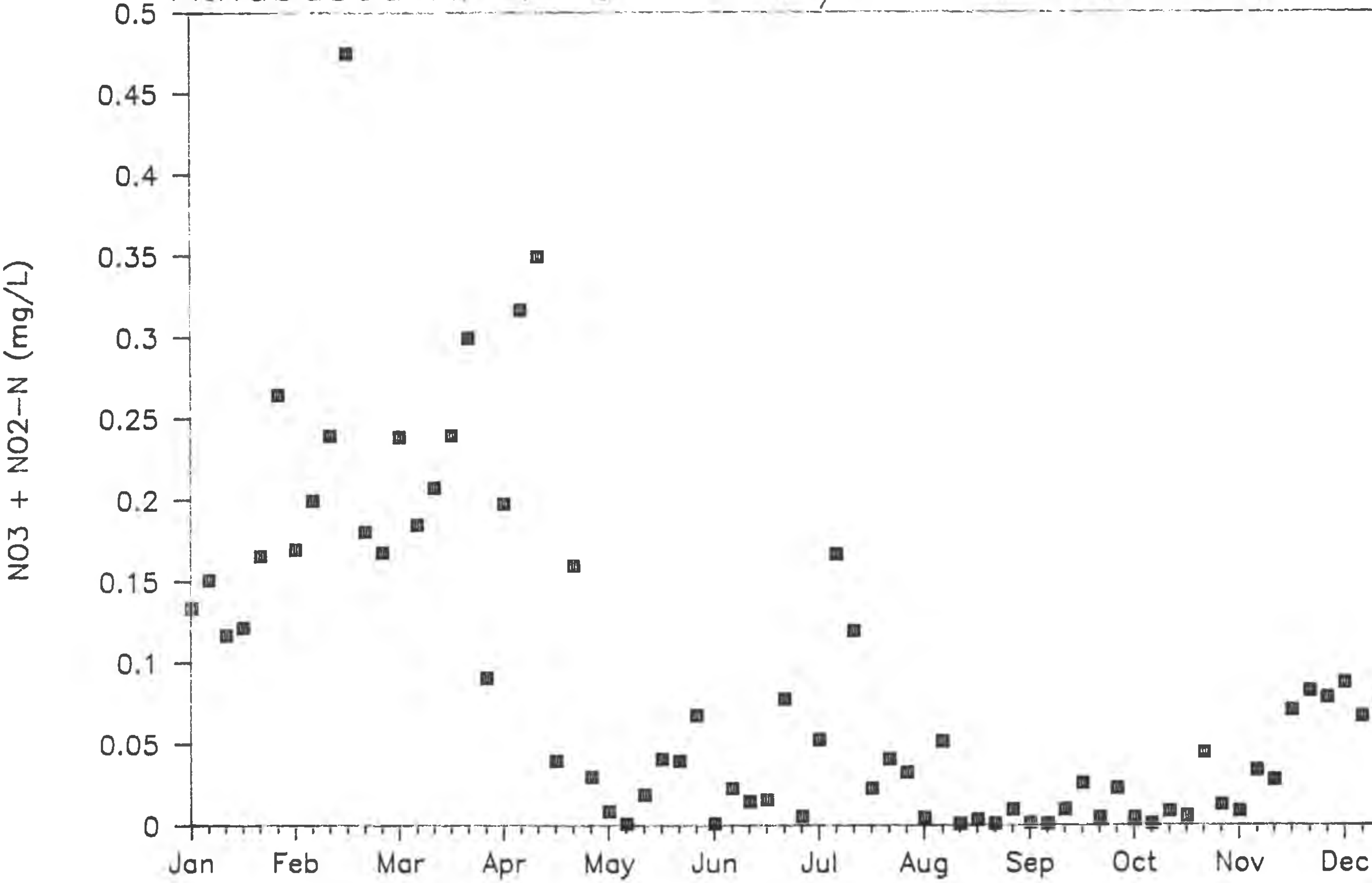


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Figure 3.

# Nitrogen - Ammonia

## Athabasca River at Athabasca 1987–1988

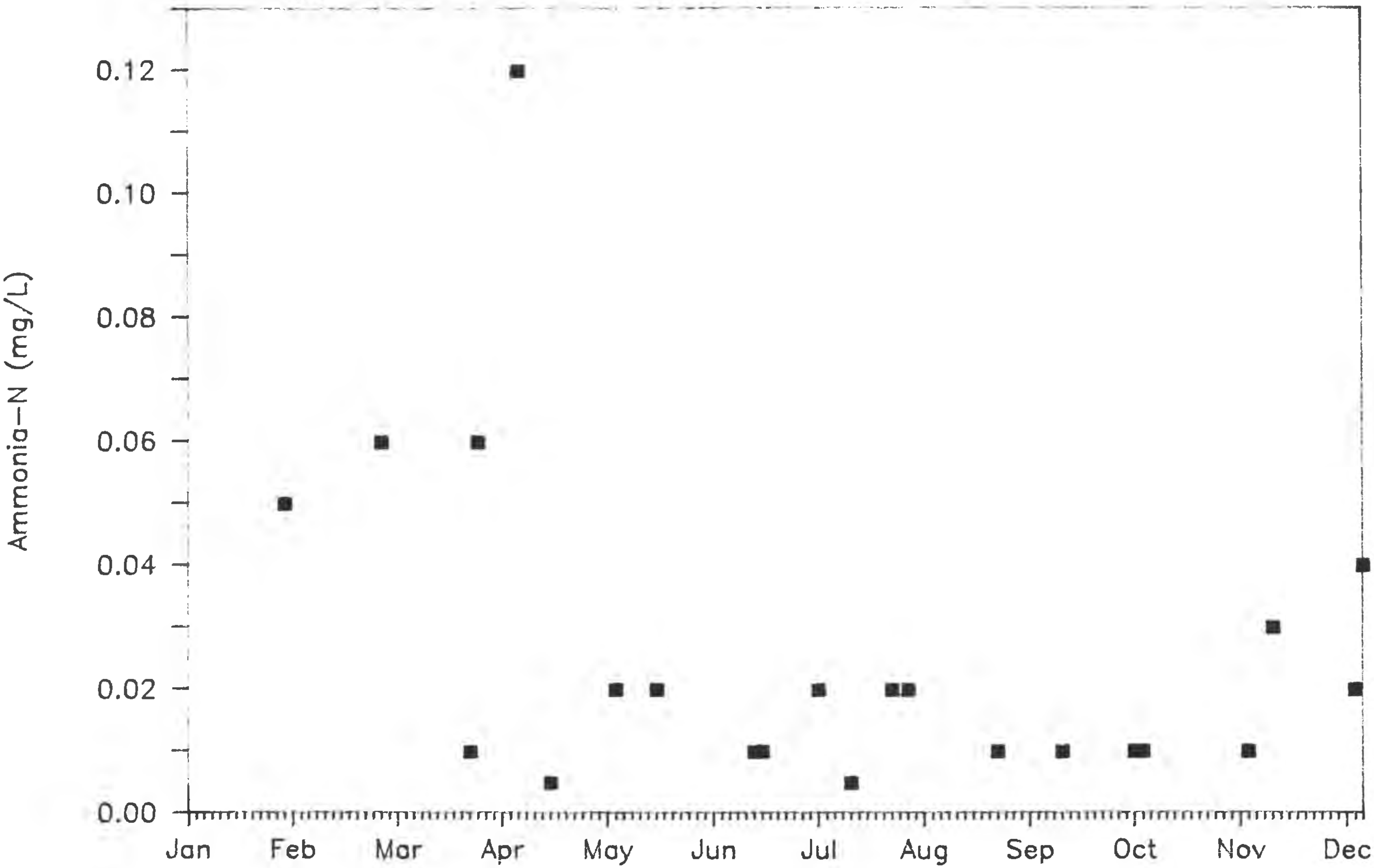


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Figure 4.

# Nitrogen - Ammonia

## Athabasca River at Old Fort/Embarras 1977–1988

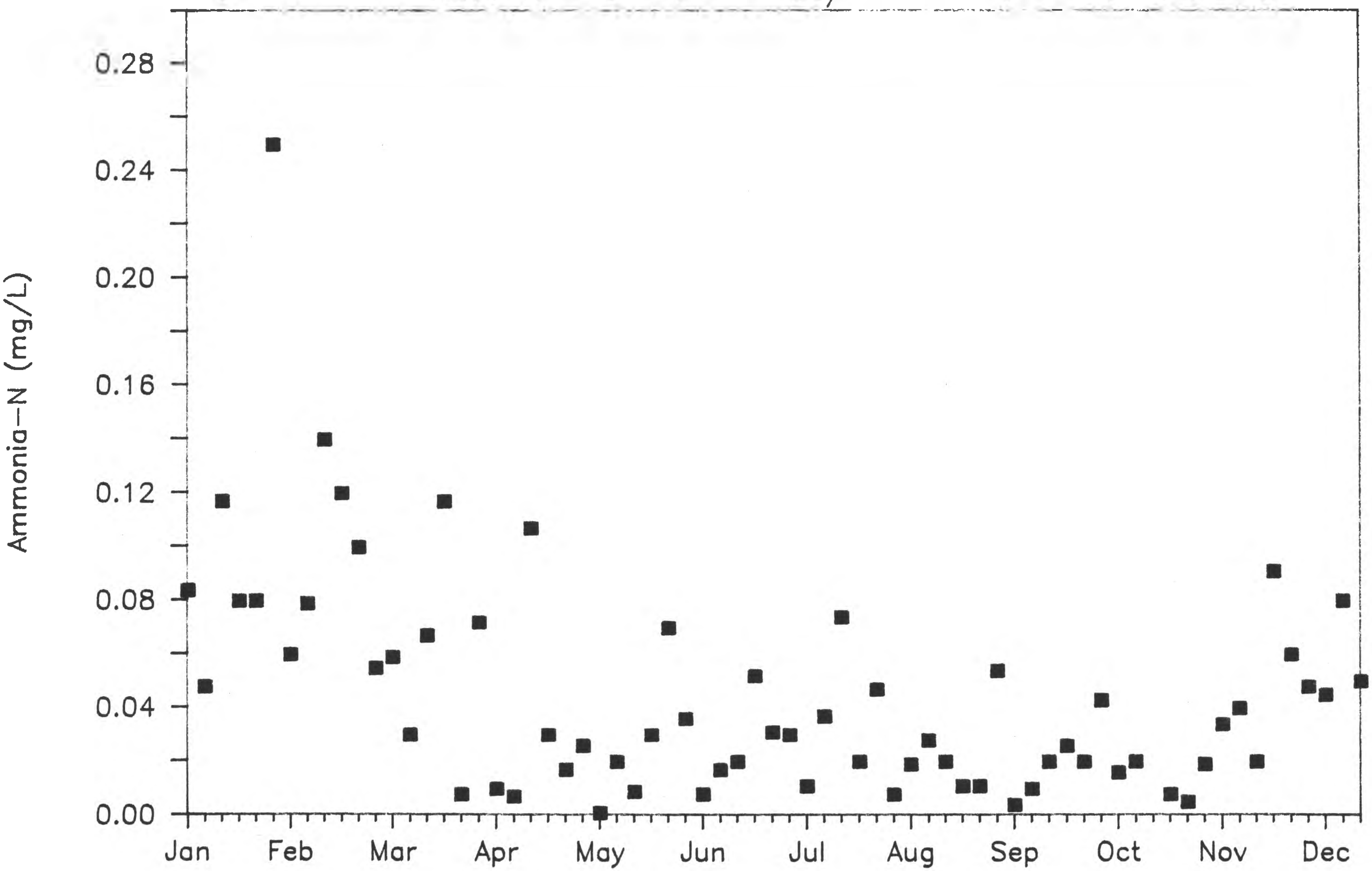


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Figure 5.

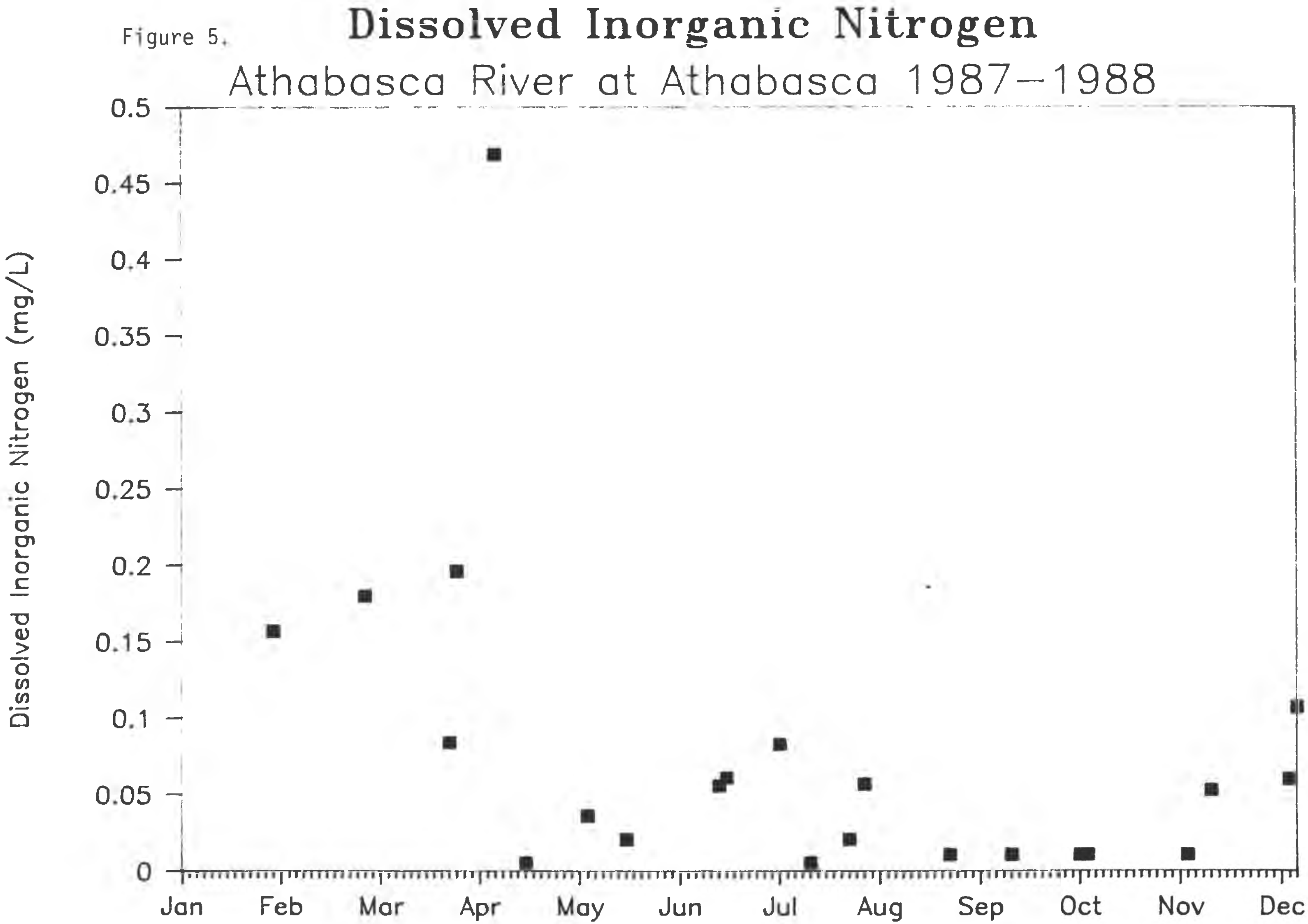


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Figure 6.

# Dissolved Inorganic Nitrogen

## Athabasca River at Old Fort/Embarras 1977–1988

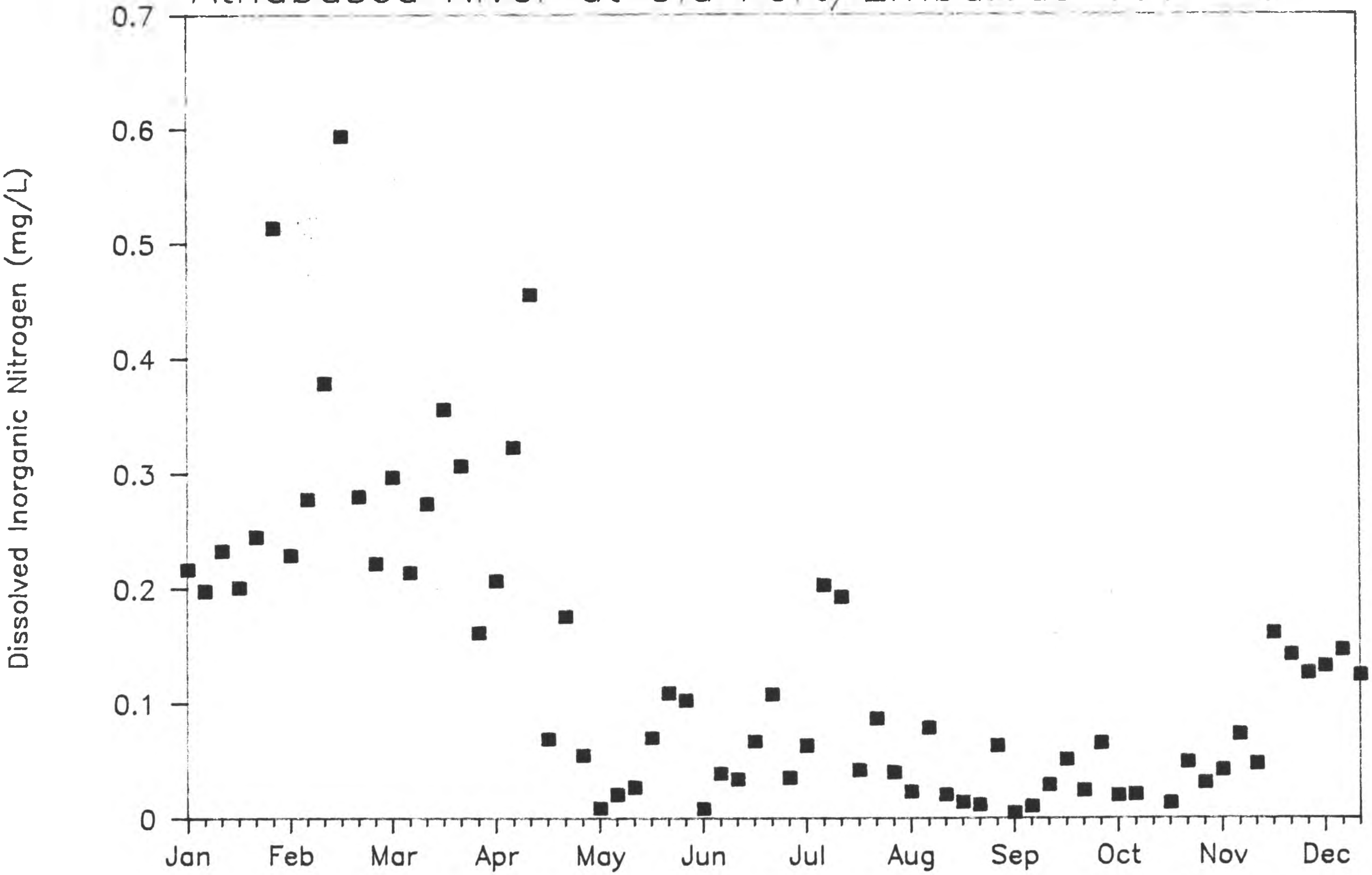


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Figure 7.

# Total Nitrogen

## Athabasca River at Athabasca 1974–1988

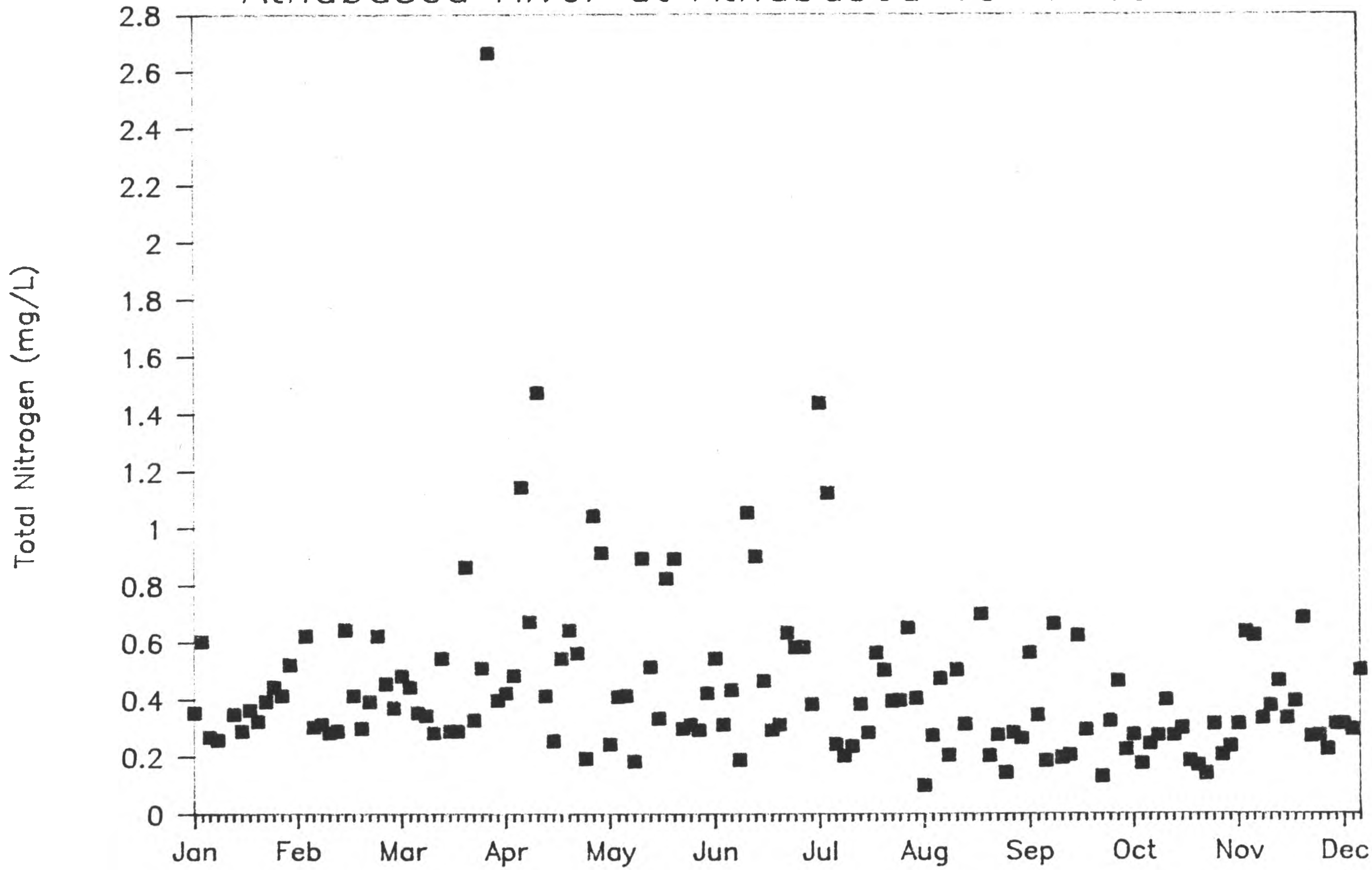


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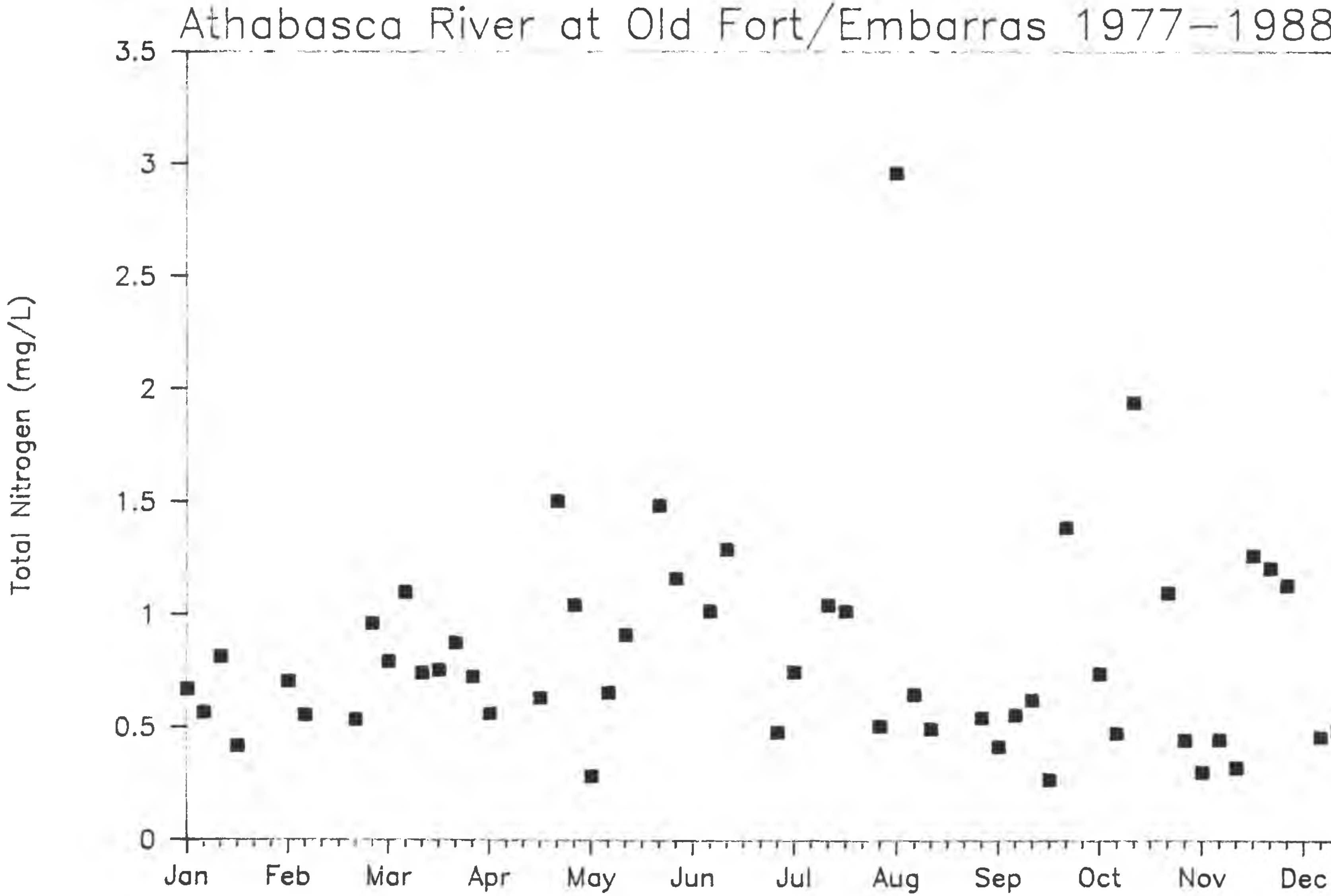
Figure 8.

# Total Nitrogen

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Environmental Quality Monitoring Branch

# A REVIEW OF THE ALBERTA-PACIFIC ODOUR PREDICTIONS

Report as requested by Dr. B. Ross at the

Alberta-Pacific Environmental Impact Assessment Review Board Hearing
held at Grassland on December 7, 1989

Prepared by

Alberta Environment
Standards and Approvals Division

2579m

This review is in response to a request by Dr. Bill Ross that an uncertainty assessment be undertaken on all odour prediction information submitted by Alberta-Pacific. (Volume 49, page 6697, lines 15-24)

SOURCES OF UNCERTAINTY

1. Emission rate. ALPAC has stated that the main contributor to odourous emissions is not a stack source but rather the activated sludge cooling pond (ref 1, pg. 14, Tab. 1). The cooling pond emission rate is very uncertain.

> "there is large uncertainty in the emission rate estimates for the cooling pond. The rates are educated guesses based on pond sulphur budgets and back calculations from ambient concentrations near existing ponds in other regions" (ref 2, pg. 5).

In their verbal responses to questions by Dr. Ross, ALPAC has stated that the emission rates used in the predictions are maximum conditions at the 99th percentile (ref 3, pg. 1223). Thus in the modelling simulations ALPAC has used a maximum emission rate and assumed that it occurs for every hour out of the simulation year.

2. Inadequate model physics. Models cannot fully describe the turbulent transport processes involved in dispersion. The EPA (ref 4) indicates that models such as ISC model used in this assessment can predict to within ± 10% to ± 40% for the maximum concentrations given typical meteorological and source data. It is expected that the ISC model used in this assessment will have this inherent random uncertainty.

3. Meteorological conditions. Uncertainty in the model predictions will be beyond the above level if meteorological data representative of the site are not used. The increase in uncertainty will depend on how dissimilar the Lac La Biche conditions (which was used in the model simulations) are to site conditions. Different meteorological data would have the greatest effect in changing the frequency of odour episodes at a given location. The frequency of odour plots which are near circular (ref 1, Figs. 4 and 5, Tab. 1) could change their shape. Thus a location which is predicted to experience 1 hour of odour may actually experience 10, or vice-versa.

4. Cooling Pond vs. Ambient Temperature. The inclusion of plume rise in the model simulations changes the concentration predictions dramatically. If no plume rise from the pond occurs the maximum concentration is 47 ppb at 2 km away from the recovery stack (ref 2, pg. 5). If it is included the maximum concentration is 0.1 ppb (ref 1, pg. 14, Tab. 1). Thus there is a factor of 470 between the two extremes. ALPAC has taken some middle ground between these two conditions and allowed partial plume rise based on matching modelling results with ambient data collected elsewhere (ref 1, pg. 14, Tab. 1). However, no information on where this data came from and how the matching was done has been provided.

Since plume rise is a result of temperature difference between the pond surface and the air, it is possible that both the no rise and full rise condition can occur. ALPAC has used a 30°C pond temperature in their modelling simulations (ref. 1, pg. 14, Tab. 1) but there will be areas of the cooling pond which would approach ambient temperatures. It is after all a cooling pond. If the air temperature is the same as the pond surface then there will be no plume rise and high concentrations will result. However, in winter some plume rise would be expected because of the larger temperature difference between the pond and ambient conditions. At the very least the partial rise approach taken by ALPAC will result in uncertainties in the maximum concentrations by a factor of 10 and would lead to uncertainties in the distance estimates to the 1 ppb isopleths of at least 3-4 km based on Figure 1 of ref 2.

5. Concentration Fluctuations. Standard regulatory models calculate one hour average concentrations. A 1 hour time average concentration comprises a series of zero and non-zero values some of which will be much greater than the time average value. It is these peak values which elicit odour sensations. Although the duration of exposure needed to obtain olfactory response is not well understood and is probably highly variable depending on the individual, it is safe to assume a sampling time in the order of seconds is more appropriate than an hour. Thus, is critical to note that even if a time average concentration is below the odour detection limit, there still exists a probability that there will be concentration peaks above the odour threshold lasting for intervals greater that the olfactory response time.
Based on a 5 ppb odour threshold, ALPAC contends that no odours will be

detected one mile from the mill (ref 1, pg. 15, Tab. 1). However, there is still a chance that a person beyond this distance will notice an odour, although it may be just for a few moments. Although difficult, the probabilities can be calculated. For example given that a dispersion model predicts an hourly average of 2.5 ppb, there is roughly a 10% chance that the threshold concentration of 5 ppb will be exceeded at any instant (ref 6).

COMPLICATING FACTORS

1. <u>The composition on the pond emissions</u>. The simulations were done assuming that all emissions are hydrogen sulphide. Other compounds may be present in small quantities such as dimethyl sulphide and dimethyl disulphide both of which have lower detection thresholds. The combination of these compounds and olfactory response is poorly understood (ref 7).

2. <u>The variability of odour detection</u>. ALPAC has suggested a threshold value of 5 ppb and have based their assessment on this value. Alberta Environment has often used a 1 ppb level recognizing that this represents a sensitive individual. Lowest threshold levels reported in the literature are 0.5 ppb (ref 7).

3. <u>Acceptability criteria</u>. Odours at these low levels may be detected but they may not be regarded as offensive (ref 7). In addition, the general population has a wide tolerance range where some would demand a no odour criteria and others would accept a 50 hours/year frequency.

Abnormal conditions. Plant upsets will occur, especially in the early life of mill operation. If something like non-condensable gas (NCG) venting occurs, odours may occur much farther downwind than indicated in the model simulations presented to date.

## SUMMARY

Given the information supplied thus far by ALPAC, a very sensitive individual (1 ppb level) will detect an odour at least 1 hour out of the year at a distance of up to 6 km away from the mill. Odours may still be detected beyond this point due to concentration fluctuations. Differences in meteorology between the site and Lac La Biche could affect the frequencies of odour occurrences. Some of the ranges of values are quantified in the Table 1 and are based on both the ALPAC submission on this matter and estimates based on the identified uncertainties. The ranges of odour impact areas that may occur could be determined by exercising the model to the limits of input uncertainty.

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TABLE 1

| UNCERTAINTY FACTORS | RESULTING ODOUR IMPACTS |
|---|---|
| <u>Emission Rate</u> | |
| maximum emissions (no plume rise) | - distance to 1 ppb, 10 km |
| 1/10 maximum emissions (no plume rise) | - distance to 1 ppb, 5-6 km |
| <u>Model Physics</u> | |
| ± 40% uncertainty in maximum concentrations | - distances to 1 ppb affected and frequency of concentrations above an odour threshold will be affected, but not systematically<br>- uncertainty less than other factors |
| <u>Meteorological Conditions</u> | |
| depends on how representative Lac la Biche atmospheric conditions are of the site | - major effect would be odour frequency plots<br>(a) close to mill: can change by 10's of hours<br>(b) at the 1 ppb distance - can change by several hours |
| <u>Cooling Pond vs. Ambient Temperature</u> | |
| no plume rise (1/10 maximum emissions) | - distance to 1 ppb, 6 km |
| partial plume rise (1/10 maximum emissions) | - distance to 1 ppb, less than 1 km |
| <u>Concentration Fluctuations</u> | |
| 10% chance that at any instant concentration two times greater than the predicted hourly average will occur | - will increase the odour detection distances determined by the model<br>- odours beyond these distances will occur less than 1 hour/year |

## REFERENCES


1 Alberta-Pacific Forest Industries Inc. Submissions to the December 7, 1989 Technical Session.

2. Air Quality Impact Assessment. Supplemental Dispersion Modelling for the Proposed Alberta-Pacific Forest Industries Athabasca Kraft PUlp Mill, prepared by Promet Environmental Group Ltd.

3. Hearing Transcripts. Lac La Biche, Part 3.

4. Environmental Protection Agency, 1984. Guideline on Air Quality Models (Revised) Draft. Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711.

5. Alberta-Pacific Forest Industries Inc., Responses to Deficiencies.

6. Sakiyama, S.K. and Angle, R.P., 1985. Calculating the Impacts of Fugitive $H_2S$ Emissions. Conference Proceedings of the Canadian Prairie and Northern Section of the Air Pollution Control Association, June 5, 1985. Calgary, Alberta.

7. Review of Ambient $H_2S$ Standards in Canada. Petroleum Association for Conservation of the Canadian Environment. PACE Report No. 85-5. Concorde Scientific Corporation, 1985.


ek/2579m

# REVIEW OF PUBLIC CONSULTATION

# SYNCRUDE EXPANSION AND

# COLD LAKE BEAVER RIVER WATER MANAGEMENT STUDY

Report as requested by Mr. P. Opryshko at the

Alberta-Pacific Environmental Impact Assessment Review Board Hearing
held at Prosperity on December 14, 1989

Prepared by

Alberta Environment
Environmental Assessment Division

0284p

This review was undertaken in response to questions from Mr. Peter Opryshko regarding public consultation (Volume 51, Page 6995, lines 24-26; Page 6996, lines 1-7, 25-26; Page 6997, lines 1-10; Page 6999, lines 12-26; Page 7000, lines 1-6 and 15-17).

## SYNCRUDE EXPANSION

The Syncrude Expansion Review Group (SERG) was established in August of 1986 upon the recommendation of senior officials of the ERCB, Alberta Environment, Syncrude and the Fort McKay Indian Band who believed that the evaluation of Syncrude's expansion application to the ERCB would be facilitated by the formation of a special review group similar to that used earlier to review the Syncrude Capacity Addition Project.

SERG membership consisted of individuals representing the foregoing groups as well as Alberta Forestry, Lands and Wildlife. SERG's purpose was to promote dialogue among its members, identify all major issues associated with the project and consider all aspects of the proposal in terms of resource and social benefits. SERG's objective was to maximize cooperation and communication among the participants and to prepare a report documenting the results of its review, areas of consensus and disagreement and whether the ERCB application should be approved.

The focus of SERG activity was on the ERCB application, including the Environmental Impact Assessment, and any independent studies deemed necessary by SERG to support the project. The application and EIA were subject to the normal interdepartmental review process and the results of this review were tabled with SERG for information and discussion.

On March 24, 1988, SERG tabled a report in conformance with their terms of reference. The document advised that all environmental issues had been identified and addressed or referred to the appropriate bodies for resolution. The report indicated that all issues raised by the participants had been thoroughly discussed. Participants believe that the resolution of issues outside the context of a public hearing enhanced the quality of the review. It concluded by recommending that the ERCB grant the application.

The ERCB provided the necessary financial support to cover reasonable costs incurred by the Fort McKay community in the areas of legal and environmental advice, as well as costs incurred by the Chief or his representative.

The acquisition of independent consultants for the purpose of undertaking technical review as deemed divisible by SERG was carried out following proper authorization from the sponsoring agencies.

On June 3, 1988 a decision was handed down by the ERCB to revise Syncrude's original Approval to permit the modifications applied for, subject to the terms and conditions to be approved by the Minister of the Environment as it affects matters of the environment, and the Associate Minister of Public Lands and Wildlife as it affects land and resources that one the property of the Crown.

# COLD LAKE - BEAVER RIVER WATER MANAGEMENT STUDY

The objectives established for the public participation component of the Beaver River Water Management study were identified by Alberta Environment as follows:

a) To obtain local input into the Cold Lake-Beaver River Study.

b) To identify critical issues related to the project as seen by local residents.

c) To inform local residents as to the scope and progress of the Study.

d) To provide a communication link between Alberta Environment and the affected communities.

The meet these objectives, a comprehensive public involvement program was developed which focused on two ongoing activities as well as a variety of other activities. (See Chronology presented in Table 1).

The regular reports were made to the Community Advisory Committee (CAC) by the Athabasca River Basin Planner at the monthly meetings of the CAC. This Committee, which developed as a result of the ESSO ERCB hearings (1978), consisted of representatives from a cross-section of groups in the Bonnyville-Cold Lake-Grand Centre area. These regular monthly updates served to keep CAC members informed about the study as well as informing the public at large through media reports of the meetings. It should also be noted that this liaison is ongoing.

The CAC office in Grand Centre was used on a contract basis as a local Study Information centre. Information and newsletters were distributed and public meetings arranged. The CAC office also served as a focal point for local people and Study staff in checking out and presenting questions and information.

The CAC maintained a very high profile during the Study process. Environment officials often met, and worked with them to insure that the local people were informed about the Study. The meetings also served as a forum where specific issues could be raised and discussed. In addition, copies of all technical reports were disseminated from the office to residents who wanted detailed technical information.

All costs incurred by local residents while participating in the study were covered by Alberta Environment.

Cold Lake - Beaver River Public Participation Program

(Key Dates and Program Activities)

---

| | |
|---|---|
| Nov. 26/80 | Planning team presentation to the Community Advisory Committee |
| July 30/81 | Final Public Involvement Program outline approved. |
| Aug. 31/81 | Summary of the Proposed Study forwarded to:<br>town councils<br>elected officials<br>public interest groups, ie. Leaps, Fish & Game |
| Sept. 8/81 | Contact with CAC formalized to:<br>1) Function as a local contact for the study steam<br>2) Distribute study documents to interested individuals in the community.<br>3) Ensure that all individuals and groups which might have an interest in the study are made aware of the study.<br>4) Coordinate and arrange public meetings in the Cold Lake regional as required (to be done in conjunction with Alberta Environment's Public participation Coordinators).<br>5) Provide the study team with regular progress reports as to how the community views the project, and any concerns that they might have with it. |
| Oct. 25/81 | 1st newsletter released. |
| Oct. 27/81 | Public meeting held in Cold Lake. Study outlined. |
| Oct. 29/81 | Public meeting held in Bonnyville. Study outlined. |
| May 10/82 | 2nd newsletters released.<br>Copies of 1st and 2nd newsletter forwarded to cottagers and others on the mailing list. |
| May 13/82 | Contact made with teachers in regards to student participation in study. |
| Oct. 25/82 | First meeting with local government Councils in Grande Centre. |
| Oct. 28/82 | Meeting with Cold Lake Band Manager. |
| Nov. 30/82 | Second meeting with local government Councils in Bonnyville. Meeting with Chief's representative. Cold Lake Indian Band. |
| Jan. 13/83 | Third newsletter distributed to area residents and mailed out. |
| Jan. 24/83 | Meeting with Cold Lake Band at Band Office. Meeting with local government Councils in Bonnyville. |

0284p

Table 1 (continued)

COLD LAKE - BEAVER RIVER PUBLIC PARTICIPATION PROGRAM

| | |
|---|---|
| Feb. /83 | 4th newsletter released, outlining management alternatives. |
| Feb. 9.83 | Public meeting in Bonnyville to review management alternatives. |
| Feb. 10/83 | Meeting with Grade ten students at St. Dominic's School, Cold Lake, Public meeting in Cold Lake. |
| Feb. 15/83 | Public meeting in Edmonton. |
| Mar. 16/83 | Minister Bradley announced Water Management Plan. Copies of press release and short term plan forwarded to local Councils, Indian Bands and CAC. |
| Apr. 14/83 | Meeting with Cold Lake Indian Band Council in Edmonton. |
| June /83 | 5th newsletter sent out, contained final short term plans. |
| Nov. /83 | Consultant Interviews for Public Involvement Review. |
| Nov. 24/83 | Workshop held in Edmonton to review public involvement component of the Cold Lake-Beaver River Management Study. |

# REVIEW OF SOURCES OF BIOCHEMICAL OXYGEN DEMAND

# IN THE PEMBINA RIVER

Report as requested by Dr. D. Schindler at the

Alberta-Pacific Environmental Impact Assessment Review Board Hearing
held at Prosperity on December 14, 1989

Prepared by

Alberta Environment
Environmental Assessment Division

This review is presented in response to a question from Dr. D. Schindler regarding the sources of BOD or low oxygen water such as the Pembina River (volume 51, page 7029, lines 14-21; page 7030, lines 17-20).

During the surveys of the last two winters, the Pembina River has been observed to have low dissolved oxygen (DO) concentrations at its mouth. Alberta Environment has not, as yet, carried out investigations to determine the cause of those low DO occurrences, however, several factors may contribute:

1. The lower Pembina River has a low gradient and meanders slowly through a flat floodplain. Such river reaches typically have complete ice cover in winter and silty beds of higher than average organic content. Both may contribute to low DO concentrations.

2. The lower Pembina floodplain is an agricultural area. Such areas can shed diffuse inputs of organic and inorganic nutrients which would contribute to a high oxygen demand in winter.

3. The Pembina receives treated municipal sewage which also contains organic and inorganic nutrients and which can be expected to contribute to the overall oxygen demand in the river. Communities discharging to the river or its immediate tributaries are Entwistle, Evansburg, Sangudo, Mayerthorpe, Barrhead and Westlock.

4. During the winter surveys of 1988 and 1989, flow in the Pembina near its mouth was less than 50% of its average winter flow.

**FT. MCKAY BAND COUNCIL RESOLUTION**
**REGARDING ATHABASCA RIVER BASIN PLAN**

Report as requested by Chief J. Boucher at the

Alberta-Pacific Environmental Impact Assessment Review Board Hearing
held at Prosperity on December 14, 1989

Prepared by


**Alberta Environment**
**Planning Division**

This information was prepared in response to a request by Chief J. Boucher regarding Alberta Environment's response to the Fort McKay Band Council resolution regarding the Athabasca River Basin Plan (Volume 51, page 7058, lines 1-15).

The Athabasca River Basin Planning Program has been underway for a few years. Much of the work conducted under the program has been directed at upstream tributaries such as the Pembina, McLeod and Lesser Slave Lake basins. The program has also collected a significant amount of mainstem Athabasca River data and conducting water quality modelling analyses which have been presented to the panel by various Alberta Environment representatives.

We are aware that the Fort McKay Indian Band Council has made representation suggesting restrictions on future developments along the Athabasca River until the planning program has been completed. The basin planning program is an ongoing process to provide available information to the public and government on the status of water management related activities in the basin. There is no "completion" date for such a process.

# FISHERIES INFORMATION ON THE ATHABASCA RIVER,

# ATHABASCA TO GRAND RAPIDS

Report as requested by Dr. D. Schindler at the

Alberta-Pacific Environmental Impact Assessment Review Board Hearing
held at Prosperity on December 14, 1989

Prepared by

**Alberta Environment**
**Environmental Assessment Division**

This information was prepared in response to a question from Dr. Dave Schindler regarding fisheries information from Athabasca to the Grand Rapids. (Volume 51, Page 7071, lines 3-15).

The Fish and Wildlife Division of Forestry, Lands and Wildlife have confirmed that the following studies are the total extent of information available for this reach of the Athabasca River.

A. Methoxychlor Studies

Fish collections were carried out between 1969-1986 in the Athabasca-Grand Rapids reach in order test for pesticide residues in fish tissue. Twenty species of fish were collected and identified, and the data are summarized in a variety of reports available from Alberta Environment.

Alberta Environmental Centre. 1984. Methoxychlor and 2,2-bis (p-methoxyphenyl)-1,1-dichloroethylene Residues in Fish in Alberta. Alberta Environmental Centre. 24 pp.

Bidgood, B.F. 1967. Chlorinated Organic Insecticides in Fish. Fish and Wildlife Division. 5 pp.

Byrtus, G. and R. Jackson. 1988. Monitoring of the Black Fly (Diptera:Simuliidae) Abatement Program on the Athabasca River - 1985. Alberta Environment. 94 pp. (not released).

Charnetski, W.A. and R.A. Currie. 1980. Pretreatment background insecticide and PCB residues and post-treatment methoxychlor insecticide residues in fish from the Athabasca River in Haufe and Croome eds. Control of Black Flies in the Athabasca River: Technical Report. Alberta Environment. pp. 75-87.

Lockhart, W.L. 1980. Methoxychlor Studies with Fish: Athabasca River Exposures and Experimental Exposures in Haufe and Croome eds. Control of Black Flies in the Athabasca River: Technical Report. Alberta Environment. pp. 183-196.

McLeod, C. 1987. The Effects of Methoxychlor Exposure on Early Life Stages of Native Fish in the Athabasca River. Alberta Environment. 21 pp. + appendices.

Murray, R.B. and R. Jackson. 1982. Athabasca River Black Fly Monitoring and Abatement Program, 1981. Prep. for County of Athabasca and I.D. #18. 78 pp.

Robertson, M.R. 1970. Results of 1969 Pesticide Tests, Athabasca River Benthos Collections and Athabasca Watershed Fish Residue Analysis. Fish and Wildlife Division. 16 pp.

Tripp, D.B. and P.J. McCart. 1979. Investigations of the Spring Spawning Fish Populations in the Athabasca and Clearwater Rivers Upstream from Fort McMurray. Volumes I & II. AOSERP Report 84. 128 pp.

B. The Fish and Fisheries of the Athabasca River Basin
Report by R. Wallace, P.J. McCart (1984)

This overview report attempts to summarize fish ecology and production data up to 1984 for the mainstem Athabasca and its major sub-basins. The reach from Athabasca town to Grand Rapids is the least understood section of the entire Athabasca Basin. Significant information is presented for only the Calling and House rivers, which are tributary to this reach. Basic fisheries data (species composition, production, population dynamics, spawning areas) are still required.

0343f

# REVIEW OF DIOXIN LOADING CALCULATIONS PERFORMED
# BY SCIENTISTS FOR THE
# GOVERNMENT OF NORTHWEST TERRITORIES AND ALBERTA-PACIFIC

Report as requested by Mr. D. Thomas at the

Alberta-Pacific Environmental Impact Assessment Review Board Hearing
held at Prosperity on December 14, 1989

Prepared by

Alberta Environment
Environmental Assessment Division

2599b

This review is in response to a question by Mr. D. Thomas regarding the loading calculations of the hypothetical contribution of dioxins and dibenzofurans from this proposed mill. (Volume 51, Page 7078, Lines 25-26; Page 7079, Lines 1-10). The loading of total dioxins and furans (TCDDs and TCDFs) was calculated by Alberta-Pacific (AlPac) and Government of the Northwest Territories (GNWT) using different methods. AlPac used the back calculation method and GNWT used theoretical calculation to estimate levels of combined dioxins and furans in total organochlorine (TOX).

I. The GNWT estimated loading of dioxins and furans was presented on December 4, 1989 and then was revised on December 15, 1989 to a seven times lower value (see attached).

Scenario I (December 4, 1989 presentation)

| | |
|---|---|
| Total pulp to be produced by AlPac | = 1500 Adt/day |
| Total organo halogens (1 kg TOX/1 Adt pulp) | = 1500 kg TOX/day |
| Total Extractable Organochlorines [EOCl] = 2% of TOX | = 30 kg/day |
| Estimated loadings of TCDDs + TCDFs based on the assumption that 1-3 ppm of dioxins and furans present in EOCl | = 0.03 to 0.09 g/day<br>Average = 0.06 g/day |
| Annual loading of combined dioxins and furans | = 0.06 g/day x 365 days<br>= 21.9 or 22 g/year (page 5867 of the transcript) |
| Concentrations in the effluent | $= \frac{0.06\ g}{80{,}000\ m^3} = \frac{0.06\ g}{80 \times 10^6 L} = \frac{60\ mg}{80 \times 10^6 L} = 0.75\ ng/L$<br>(AlPac number)<br>= 750 pg/L<br>= 750 ppq |

Detection Limit (DL) for TCDDs + TCDFs = 10 ppq - 30 ppq

* ppq = part per quadrillion = picogram/litre
picogram is $10^{-12}$g
ppq = 1 second in 32,000,000 years

2599b

Scenario 2 (December 15, 1989)

The GNWT recalculated the loading estimate of TCDDs + TCDFs using a different value for the concentration of TCDDs + TCDFs in TOX from a different reference source. The revised value yielded 0.01 g/day of TCDDs + TCDFs instead of 0.06 g/day calculated by Scenario 1.

Therefore:

| | |
|---|---|
| The estimated loading of TCDDs + TCDFs per day | 0.01 g |
| The estimated loading of TCDDs + TCDFs per annum | 3.65 g |
| Concentration in the effluent | 125 pg/L<br>125 ppq |
| DL for TCDDs + + TCDFs | 10-30 ppq |

The estimated loading calculated by the GNWT expert panel is several times higher than the DL commonly achieved by most analytical laboratories and hence should easily be detected in the effluent.

Effluent analysis of other bleached kraft mills in Alberta have shown non-detectable concentrations of TCDDs + TCDFs. The recent survey conducted by Environment Canada - Canadian Pulp and Paper Association (CPPA) under the National Dioxin Survey Program covering all 46 kraft mills across Canada has shown non-detectable concentrations of tetra, penta, hexa, hepta, and octa dioxins in Alberta pulp mill effluents (see attached). However, 2,3,7,8-TCDF was detected at 94 ppq level with other congeners of furans not detected. It has to be noted that 2,3,7,8-TCDF is 10 times less toxic than the 2,3,7,8-TCDD.

2599b

II. AlPac calculated the loading of dioxins from the effluent DL of 10 ppq.

DL for TCDDs + TCDFs in the effluent = 10 pg/L or 10 ppq

Amount of dioxins in 80,000 $m^3$ or 80 x $10^6$ L of effluent is

$$10 \text{ pg} \times 80 \times 10^6 = 800 \times 10^6 \text{ pg} = 8 \times 10^8 \text{ pg} = 8 \times 10^2 \text{ ug} = 800 \text{ ug} = 0.8 \text{ mg}$$

Calculated loading of dioxins per day = 0.0008 g

Calculated loading of dioxins per annum = .0008 x 365 g = 0.292 g

The AlPac calculation assumes that the DL 10 ppq is applicable to effluents all the time. However, the DL fluctuates depending on the non-homogeneity of the effluent. The DL range reported by most analylical laboratories for dioxin/furan is 10-30 ppq for pulp and paper effluent. A recent Environment Canada - CPPA survey also agrees with this range. Hence, the calculated loading using the upper DL of 30 ppq would amount to 0.0024 g/day and 0.876 g/year.

This number would provide a margin of error for the uncertainties in the detection of dioxins and furans and also account for the toxicity of non-analyzed 2,3,7,8-TCDF which will be 1/10 of 2,3,7,8-TCDD. Note that these are end-of-pipe loading levels and are more or less constant numbers. The ambient concentration varies depending on the flow, volume, turbidity levels, and other physico-chemical properties of receiving waters downstream and will be much lower than the loading level. It is the concentration in water that determines the biouptake, abiotic uptake by sediments, etc. and not the total loading. Several surveys conducted in Canada, including a major study by Ontario Ministry of Environment, did not detect tetra and penta dioxins and furans in ambient waters.

SUMMARY TABLE

| | Scenario I (GNWT) | Scenario 2 (GNWT) | AlPac | Calculated loading based on practical Detection Limit |
|---|---|---|---|---|
| The estimated loading of dioxins and furans per day | 0.06 g | 0.01 g | 0.0008 g | 0.0024 g |
| The estimated loading of dioxins and furans per annum | 22.0 g | 3.65 g | 0.292 g | 0.876 g |
| Concentration in the effluent | 750 ppq | 125 ppq | non detectable | non-detectable |

THE ALBERTA-PACIFIC

ENVIRONMENT IMPACT ASSESSMENT REVIEW BOARD

PUBLIC HEARING

# Filed Document

J-58

By: Government of the Northwest Territories

29 pages

# A PRELIMINARY ASSESSMENT OF DOWNSTREAM EFFECTS

# A BRIEF EXAMINATION OF THE TOXIC EFFECTS IN RELATION TO UPSTREAM PULP MILL DEVELOPMENTS

## FORMING

## ANNEX 3

SUBMISSION OF THE GOVERNMENT OF THE NORTHWEST TERRITORIES

TO

THE ALBERTA-PACIFIC
ENVIRONMENTAL IMPACT ASSESSMENT REVIEW BOARD

FORT SMITH, NORTHWEST TERRITORIES
NOVEMBER 16, 1989
(revised November 22, 1989)

Note: This is an update of the November 16 draft document. It adds:

a) references; and
b) revised numbers to better reflect information available from ALPAC and elsewhere.

While some of the specific numbers have changed in this update, the conclusion remain the same.

This document was prepared at the request of the Government of the Northwest Territories by the Rawson Academy of Aquatic Science.

## 4. NIAGARA - ATHABASCA / SLAVE COMPARISON (MIREX AND TCDD + TCDF)

Since the bio-accumulations of dioxins and furans are likely to share many similarities with the Lake Ontario mirex example [1], can we make any comparable predictions for the Mackenzie drainage? Perhaps we can!

The proposed ALPAC mill will produce 1500t air dried pulp (Adt) per day, with a discharge of 1500 kg of total organo-halogens (TOX) per day (data provided by Alberta Pacific - ALPAC). Based on Swedish data derived from sediment samples (conservative data, unaffected by bio-accumulation), TCDD + TCDF represent between 1 and 3 parts per million of EOCl (extractable organo-chlorines) [6]. Since EOCl represents about 2% of TOX on a relative basis [7], this means that a daily discharge of 1500 kg (TOX) could contain 0.03 - 0.09 g of combined dioxins and furans (TCDD + TCDF), that is the **loading of TCDD + TCDF = 0.03 - 0.09 $g.d^{-1}$**.

This may be compared to the mirex loading of 62.7 $g.d^{-1}$ in the Niagara River. Firstly, to convert loadings into concentrations, we must adjust values for relative differences in the flows of receiving waters. The average flow of the Niagara River is 6800 $m^3 . sec^{-1}$, the flow of the Athabasca River at Embarras is 783$m^3 . sec^{-1}$ and of the Slave River at the Great Slave outlet it is 4284 $m^3 . sec^{-1}$ ( data from Environment Canada). Thus, concentrations of TCDD + TCDF in the Athabasca may be expected to range between 0.42 and 1.25 ppq[c] . and at the Great Slave Lake outflow between 0.08 and 0.24 ppq[d] .

By comparison, concentrations of mirex in the Niagara River ranged between about 85 - 255 times greater than potential TCDD + TCDF in the Athabasca River, and between 445 - 1335 times greater than in the Great Slave Lake Outlet. However, since TCDD + TCDF is likely greater than 1000 times more toxic than mirex, even at these incredibly low concentrations, discharge from the bleached kraft mill effluent is likely to be at least as toxic, if not more toxic, in its impact on the Mackenzie River system than mirex in the Great Lakes region.

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[c] 100 x (6800 / 783) x (0.03 / 62.7) to 100 x (6800 / 783) x (0.09 / 62.7)
[d] 100 x (6800 / 4284) x (0.03 / 62.7) to 100 x (6800 / 4284) x (0.09/ 62.7)

# Table of Contents

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# PRESS RELEASE

## Alberta, Saskatchewan, and Manitoba pulp industry release dioxin test results

Montreal, 15 December 1989 - The Canadian Pulp and Paper Association and the Pulp and Paper Research Institute of Canada today released the results of a national dioxin testing program for chemical pulp mills in Alberta and Saskatchewan. Results for mills in British Columbia and New Brunswick were published recently and those for mills in Ontario, Québec, and Nova Scotia will be distributed shortly.

The test results, which have been given to the federal and provincial authorities, are part of the National Dioxin Characterization Program of Canada's 45 bleached chemical pulp mills. Prairie provinces test samples were collected in the spring and summer of 1989 by Beak Consultants Limited and subsequently analyzed by Seakem Analytical Services Ltd. in Sidney, B.C., and therefore do not reflect the current levels of dioxins and furans which are expected to be lower because of process changes made since that time. It should be noted that the mill in Manitoba does not have a bleach plant and, as expected, has dioxin (2,3,7,8 TCDD) and furan (2,3,7,8 TCDF) levels that were non-detectable. This mill was included in the survey for comparison purposes only.

The test results for pulp, sludge, and final effluent are at the low end of the range of results reported in the U.S. earlier this year for mills using similar technology.

Quality assurance controls were developed by joint government/industry groups of analytical chemists following protocols established in cooperation with Environment Canada, prior to the commencement of this program. The program was funded by Canadian pulp companies.

Dioxin (2,3,7,8 TCDD) and furan (2,3,7,8 TCDF) test results for pulp, sludge, and final effluent, as well as organochlorine (AOX) test results for effluents are included in the report.

Of the three mills tested in Alberta and Saskatchewan organochlorine discharges ranged from 1.1 to 2.9 kg/tonne. Each mill site has a secondary effluent treatment system.

Dioxin (2,3,7,8 TCDD) levels were non-detectable in the pulp from one mill and the remaining plants had readings ranging from 2.5 to 3.1 parts per trillion (ppt). Furan levels in pulp ranged from 2.3 to 17 ppt.

In sludge samples, dioxin levels ranged from 1.5 to 10 ppt, while the furan readings ranged from 9.4 to 62 ppt.

The dioxin levels in final effluents were non-detectable at all three mills although furan readings ranged from 30 to 94 parts per quadrillion (ppq).

Since traces of dioxin were first detected in pulp mill effluent in the fall of 1987, the Pulp and Paper Research Institute of Canada has undertaken a research program aimed at understanding how dioxins and furans are formed and identifying process changes that will virtually eliminate these undesirable compounds. This research is continuing.

As a result, companies in the Prairie provinces and elsewhere in Canada have responded with a number of initiatives: substituting chlorine dioxide or other non-dioxin producing oxidants for some of the chlorine conventionally used in the bleaching process; using reformulated defoamers free of dioxin precursors; and using wood chips, hog fuel, and sawdust that have not been contaminated by pentachlorophenol, a wood preservative proven to have been one of the sources of certain dioxins in pulps and effluents before its use was discontinued by the lumber mills.

Industry research has also indicated that steps to reduce dioxins are highly effective in reducing other organochlorine compounds.

A complete copy of the detailed data for companies in Alberta, Saskatchewan, and Manitoba can be obtained through the Pulp and Paper Research Institute of Canada or the Canadian Pulp and Paper Association.

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For more information:

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# CPPA NATIONAL MILL DIOXIN CHARACTERIZATION SURVEY

## PRAIRIE PROVINCES

| Company | Location | Pulp | | Final Effluent | | Sludge | |
|---|---|---|---|---|---|---|---|
| | | ppt 2378 TCDD | ppt 2378 TCDF | ppq 2378 TCDD | ppq 2378 TCDF | ppt 2378 TCDD | ppt 2378 TCDF |
| **MILLS EMPLOYING KRAFT PULPING TECHNOLOGY WITH BLEACHING PROCESS** | | | | | | | |
| PROCTER & GAMBLE | Grande Prairie, Alberta | ND (1.1) | 2.3 | ND (31) | 94 | 10 | 36 |
| WELDWOOD | Hinton, Alberta | 2.5 | 17 | ND (48) | 77 | 10 | 62 |
| | | 2.8 | 18 | - | - | - | - |
| WEYERHAEUSER | Prince Albert, Saskatchewan | 3.1 | 6.2 | ND (31) | 30 | 1.5 | 9.4 |
| **MILL EMPLOYING KRAFT PULPING TECHNOLOGY WITHOUT BLEACHING PROCESS** | | | | | | | |
| REPAP | The Pas, Manitoba | - | - | ND (47) | ND (38) | ND (1.6) | ND (1.3) |

ND - Non-detectable figures in brackets reflect detection limit of the analysis.
ppt - Parts per trillion
ppq- Parts per quadrillion

SAMPLE TYPE: Effluent

REPORT DATE: August 11, 1989

SAMPLE SIZE: ______ g (air dry)

0.952 L (liquid)

259 mg of particulate (effluent)

FINAL VOLUME: 20 µL

SAMPLE CODE: 5242

CONTRACT LAB CODE: 297-113

| ISOMER | pg/o.d.g or pg/L | DL | NI | RATIO | ACCEPTABLE RATIO RANGE |
|---|---|---|---|---|---|
| 2,3,7,8-$T_4$CDD | ND | 31 | 0 | - | 0.63 - 0.95 |
| $T_4$CDD (Total) | ND | 31 | 0 | - | 0.63 - 0.95 |
| $P_5$CDD | ND | 63 | 0 | - | 0.52 - 0.78 |
| $H_6$CDD | ND | 77 | 0 | - | 0.66 - 0.98 |
| 1,2,3,4,6,7,8-$H_7$CDD | ND | 87 | 0 | - | 0.78 - 1.18 |
| $H_7$CDD (Total) | ND | 87 | 0 | - | 0.78 - 1.18 |
| $O_8$CDD | ND | 140 | 0 | - | 0.72 - 1.08 |
| 2,3,7,8-$T_4$CDF | 94 | 37 | 1 | 0.94 | 0.62 - 0.94 |
| $T_4$CDF (Total) | 130 | 37 | 2 | 0.94 0.71 | 0.62 - 0.94 |
| $P_5$CDF | ND | 32 | 0 | - | 0.50 - 0.74 |
| $H_6$CDF | ND | 58 | 0 | - | 0.66 - 0.98 |
| $H_7$CDF | ND | 76 | 0 | - | 0.74 - 1.10 |
| $O_8$CDF | ND | 100 | 0 | - | 0.73 - 1.09 |

urr.
ec.

| | | | | | |
|---|---|---|---|---|---|
| $^{13}C_{12}$-TCDF | 72 | | | | |
| $^{13}C_{12}$-TCDD | 70 | | | | |
| $^{13}C_{12}$-$P_5$CDD | 84 | | | | |
| $^{13}C_{12}$-$H_6$CDD | 84 | | | | |
| $^{13}C_{12}$-$H_7$CDD | 76 | | | | |
| $^{13}C_{12}$-$O_8$CDD | 67 | | | | |

1. DL/NI = Detection Limit/Number of Isomers (or Peaks Resolved).
2. o.d.g = oven-dried weight in grams.
3. ND = Not Detected.
4. NDR = Peak present but does not meet identification criterion for isotopic molecular ion ratio.
5. Value for 2,3,7,8-$T_4$CDF is the maximum amount. This isomer is one of three which are known to co-elute on a DB-5 column.

APPROVED [illegible] DATE August 11, 1989

Resource Futures International (RFI) Inc.
Vancouver Calgary Ottawa Halifax

a consulting arm of the Rawson Academy of Aquatic Science

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December 15, 1989

The Chairman and Members of the Board
Alberta Pacific EIA Review Board
15th floor, 10405 Jasper Ave.
Edmonton, Alberta
T5J 3N4

BY FAX to (403) 422-9333
(original to follow by mail)

Dear Mr. DeSorcy and Members of the Board:

Supplementary Submission
RE: Organochlorine Loadings, Update of Annex 3, GNWT Presentation

The Government of the Northwest Territories (GNWT) has asked us to respond to you directly to clarify matters raised in a press release from ALPAC dated December 7, 1989, a copy of which is attached. We shall also be responding in detail to ALPAC's organochlorine information on or before January 15, 1990 as requested by the Board.

We have reviewed all calculations in Annex 3 entitled A Preliminary Assessment of Downstream Effects: A Brief Examination of the Toxic Effects in Relation to Upstream Pulp Mill Developments, revised and dated November 22, 1989. We have also reviewed the transcripts of the technical hearing on December 4, 1989 held in Edmonton. Transcripts of the December 7, 1989 hearing are not yet available.

The information in question was first presented to the Board by us in Fort Smith, NWT on November 16, 1989. At that hearing, ALPAC requested that we attend the hearings of the Board, scheduled for Edmonton in December, to answer their questions. We agreed to do so. We requested a prior meeting of technical experts to establish facts on both sides. That meeting did not occur.

At the Board's technical hearings in Edmonton on December 4, 1989, ALPAC asked only one question. That question was directed to Dr. Hallett who was present as one of three experts to respond to questions on the Annex 3 to the GNWT submission. This Annex was a November 22, 1989 update of the November 16, 1989 draft presented in Fort Smith. The update had been circulated to ALPAC and the Board, as promised by us, well before the Edmonton hearing.

The question by ALPAC's Dr. Halloran (transcript pages 5899 & 5900) related to "TCDD or associated compounds". It suggested that in his summary comments, Dr. Hallett *erred on the high side by a factor of 100*, and asked him if he wished to revise his comments and comparisons.

Dr. Hallett responded (page 5921 and 5922 of the transcript). He stated that he based his comments on Annex 3 of the updated submission. He was referring to page 5, second paragraph of Annex 3 where it is stated that "a daily discharge of 1500 kg (TOX) could contain 0.03 - 0.09 g of combined dioxins and furans (TCDD+TCDF), that is the loading of TCDD+TCDF = 0.03 - 0.09 $g.d^{-1}$." (The number 22 g/yr he used in his verbal presentation was derived by multiplying the median value of 0.06 g/day by 365 days/year.)

Dr. Hallett concluded by saying, "I would emphasize to the Board and to ALPAC that the calculation is not the basis of any of the concerns or conclusions that I reached" (page 5921). The major conclusion (page 5865, lines 5-7) is based on the evidence of existing contamination of the fishery with 2,3,7,8 TCDD and 2,3,7,8 TCDF from the existing pulp and paper mills and the use of this fishery as a principal food source. ALPAC had no other questions of our experts.

On December 7th, three days later and without contacting the GNWT or any members of its expert panel, ALPAC issued the attached press release. The main reference in the press release was to "Annex 3, page 4". (In fact, the reference in question is on page 5.) The press release states that errors were made by us in underlying calculations and that these errors are material. The appropriate time and place, for such matters to have been addressed in full, was before the Board at the Edmonton hearing at which we were present.

As the experts who prepared Annex 3, we have reviewed all the underlying calculations. Four points arise from this review.

- ALPAC's estimates appear to relate to the discharge of 2,3,7,8 TCDD. The GNWT Annex 3 uses the combined 2,3,7,8 TCDD + 2,3,7,8 TCDF discharges which are consistently 10 times higher than the TCDD alone. The combined effect is the most reasonable scientific basis for evaluating impacts.

- The estimates of 2,3,7,8 TCDF + 2,3,7,8 TCDD should be 0.01 g/d, and not 0.03-0.09 g/d as stated on page 5 of Annex 3. These calculations do not take into account the presence of other effluent-related chemicals that would be associated with the loadings of dioxins and furans. The toxic effect of many such chemicals will be additive.

- This estimate in turn suggests a decrease in the annual loading calculated by Dr. Hallett from 22 g/yr to 3.65 g/yr. The loading is still high.

- The conclusions of Annex 3 remain valid (pages 20 and 21). The change in numbers does not affect the substance of the submission of the Government of the Northwest Territories.

*I am also* attaching to this letter a more detailed explanation of our review. If you have any questions, or if we can provide additional information to assist the Board in any way, please do not hesitate to call.

Sincerely,

Donald J. Gamble
President
and on behalf of the GNWT's Panel of Experts
Dr. Peter Sly, Dr. Douglas Hallett and Dr. Wayland Swain

encl.

cc: Deputy Minister, Renewable Resources, Yellowknife
Vice President, Alberta-Pacific Forest Industries Inc., Edmonton
Deputy Minister, Alberta Environment, Edmonton
Regional Director General, Environment Canada, Edmonton
Regional Director General, Indian and Northern Affairs, Yellowknife

3. If ALPAC and others have additional information, wish to interpret the published information in a different way or wish to qualify the available data on the basis of other considerations, they should do so in a manner that allows a full assessment of the assumptions and qualifications used.

4. As noted in the text and references of Annex 3, there is substantial published information from Sweden describing near field and far field environmental impacts of pulp mill effluents. There is also considerable evidence from the Great Lakes on the movement and effects of persistent toxic substances. Both are considered to be relevant in the manner described in Annex 3, particularly because they assist in understanding the possible downstream and cumulative impacts of the proposed ALPAC mill. These impacts, and the current state of the river system, are the main concern to the people of the NWT.

5. Swedish data were used to relate TOX or TOCL (treated as equivalent) to EOCL and to relate EOCL to 2,3,7,8 TCDD + 2,3,7,8 TCDF (*combined* "dioxin" and "furan"). Figure 9.7 in Reference 6 of Annex 3 indicates that, in sediments, there is a fairly constant ratio of about $3 \times 10^6 : 1$ of EOCL : (2,3,7,8 TCDD + 2,3,7,8 TCDF). Reference 7 (see page 13) indicates that EOCL comprises about 2 per cent of 2,3,7,8 TOCL. Therefore, 2,3,7,8 TCDD + 2,3,7,8 TCDF represents about 1 part in 150 million.

6. If the ALPAC discharge of 1500 kg TOX/day is accepted as the basis for calculations, this yields a loading of 0.01 g/day or 3.65 g/year of 2,3,7,8 TCDD + 2,3,7,8 TCDF. Therefore, the loadings estimate on page 5 of Annex 3 should be revised to read 0.01 g/day. This change and the related numerical adjustments on four other pages will be submitted to the Board and others in a revised draft to be sent under separate cover. The changes do not affect the main argument presented in Annex 3 nor do they affect the conclusions.

7. Since 2,3,7,8 TCDD + 2,3,7,8 TCDF association with fine sediments will occur in the suspended load, it is unlikely that contaminated sediment impacts will be reduced by the same amount. More likely the reduction will be less. This load will be carried towards the Athabasca Delta and the NWT border.

8. There is evidence now that 2,3,7,8 TCDD + 2,3,7,8 TCDF appears in fish in the Athabasca/Slave River system and likely, also, in sediments of the area. Levels have been detected that are similar to levels found in fish in Lake Ontario, and using Ontario sport fish guidelines, these Alberta fish are very close to consumptive limits. Using New York State guidelines for sport fish, the existing levels in the Athabasca are well above consumptive limits. Since many downstream peoples, particularly Native peoples, eat more fish than assumed in establishing either the Ontario or New York guidelines, they are already a population at risk.

# Explanation

## Supplementary Submission

## Presentation of the Government of the NWT

**ORGANOCHLORINE REASSESSMENT, ANNEX 3**
an attachment to the December 15, 1989 RFI Inc. letter
to the
ALPAC EIA Review Board

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1. There is a difference in how ALPAC and the GNWT address the issue of organochlorines in pulp mill effluent. This may have led to some of the current confusion. For example:

   - the GNWT presents the information as *loadings* and not *concentrations* for the reasons described in its brief and explained by the GNWT experts on December 4, 1989. It is the loadings, not the concentrations of these substances, that are of primary concern in terms of downstream impact. Dwelling on concentrations, whether they be below detection limits or not, understates the impacts.

   - the GNWT's experts' approach has been to consider not just 2,3,7,8 TCDD or some unspecified "dioxin", but rather to address impact through examination of the combined 2,3,7,8 TCDD *plus* 2,3,7,8 TCDF, and where possible the total organo-halogen(TOX) effect. The reasons for this are explained and referenced in Annex 3 (see for example the CCREM reference 1). It is the impact of the loading of the organochlorines that is of paramount concern in the Board's assessment, not the specific role of any one congener.

   The GNWT's experts consider their approach to be a scientifically sound basis for addressing the cumulative and downstream matters before the Board.

2. Annex 3 was developed on the basis of available information, with particular emphasis on scientifically valid material from the published literature and other technical information related to demonstrated performance of pulp and paper technology. The Annex, as updated from the November 16th draft and delivered to the Board and ALPAC prior to the Edmonton hearing on December 4, 1989, is fully referenced and indicates all calculations and extrapolations. ,