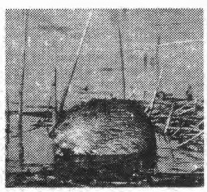
Canada Alberta Northwest Territories

Northern River Basins Study

INCLUDES COMPUTER DISK



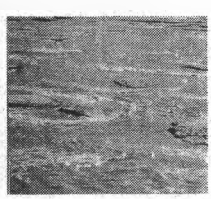


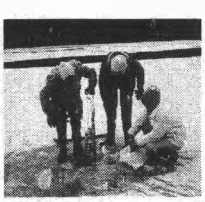



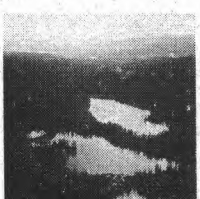


NORTHERN RIVER BASINS STUDY PROJECT REPORT NO. 144

AN ANNOTATED BIBLIOGRAPHY OF CONTAMINANTS IN THE PEACE, ATHABASCA AND SLAVE RIVER BASINS








Prepared for the
Northern River Basins Study
under Project 2112-B1

by

SENTAR Consultants Ltd.

NORTHERN RIVER BASINS STUDY PROJECT REPORT NO. 144

AN ANNOTATED BIBLIOGRAPHY OF CONTAMINANTS IN THE PEACE, ATHABASCA AND SLAVE RIVER BASINS

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PREFACE:

The Northern River Basins Study was initiated through the "Canada-Alberta-Northwest Territories Agreement Respecting the Peace-Athabasca-Slave River Basin Study, Phase II - Technical Studies" which was signed September 27, 1991. The purpose of the Study is to understand and characterize the cumulative effects of development on the water and aquatic environment of the Study Area by coordinating with existing programs and undertaking appropriate new technical studies.

This publication reports the method and findings of particular work conducted as part of the Northern River Basins Study. As such, the work was governed by a specific terms of reference and is expected to contribute information about the Study Area within the context of the overall study as described by the Study Final Report. This report has been reviewed by the Study Science Advisory Committee in regards to scientific content and has been approved by the Study Board of Directors for public release.

It is explicit in the objectives of the Study to report the results of technical work regularly to the public. This objective is served by distributing project reports to an extensive network of libraries, agencies, organizations and interested individuals and by granting universal permission to reproduce the material.

NORTHERN RIVER BASINS STUDY
PROJECT REPORT RELEASE FORM

This publication may be cited as:

SENTAR Consultants Ltd. 1997. ***Northern River Basins Study Project Report No. 144, An Annotated Bibliography of Contaminants in the Peace, Athabasca and Slave River Basins.*** **Northern River Basins Study, Edmonton, Alberta.**

Whereas the above publication is the result of a project conducted under the Northern River Basins Study and the terms of reference for that project are deemed to be fulfilled,
IT IS THEREFORE REQUESTED BY THE STUDY OFFICE THAT;
this publication be subjected to proper and responsible review and be considered for release to the public.

(Dr. Fred J. Wrona, Science Director) — (Date) 14 May 96

Whereas it is an explicit term of reference of the Science Advisory Committee "to review, for scientific content, material for publication by the Board",
IT IS HERE ADVISED BY THE SCIENCE ADVISORY COMMITTEE THAT;
this publication has been reviewed for scientific content and that the scientific practices represented in the report are acceptable given the specific purposes of the project and subject to the field conditions encountered.
SUPPLEMENTAL COMMENTARY HAS BEEN ADDED TO THIS PUBLICATION: [ ] Yes [ ] No

(Dr. P. A. Larkin, Ph.D., Chair) — (Date) 24 May /96

Whereas the Study Board is satisfied that this publication has been reviewed for scientific content and for immediate health implications,
IT IS HERE APPROVED BY THE BOARD OF DIRECTORS THAT;
this publication be released to the public, and that this publication be designated for: **[ ] STANDARD AVAILABILITY [ ] EXPANDED AVAILABILITY**

(Lucille Partington, Co-chair) — (Date) May 29/96

(Robert McLeod, Co-chair) — (Date) May 21/96

AN ANNOTATED BIBLIOGRAPHY OF CONTAMINANTS IN THE PEACE, ATHABASCA AND SLAVE RIVER BASINS

STUDY PERSPECTIVE

> ***Related Study Questions***
>
> 2) *What is the current state of water quality in the Peace, Athabasca and Slave River basins, including the Peace-Athabasca Delta?*
>
> 5) *Are the substances added to the rivers by natural and man-made discharges likely to cause deterioration of the water quality?*

The aquatic environments contained within the Northern River Basins Study area (NRBS) were being described and monitored prior to the onset of the Study. Even though effluents arising from pulp and paper mills were the subject of considerable Board and public interest, other municipal and industrial effluents were also identified as potential areas of concern. Difficulties existed in understanding the cumulative effects of development because of disparate information bases and information gaps. Consequently, the NRBS Board identified a need to capitalize on existing knowledge to better understand the influence of effluents on the receiving waters of the Peace, Athabasca and Slave rivers and their major tributaries and assist in directing the future investment of Study funds. It was also acknowledged that an existing scientific literature relating to effluents, particularly as it concerned contaminants and the ecotoxicity of various effluents to the aquatic environment, should complement any data gathering and interpretation. A seven step multifaceted project was initiated under the Contaminants Component to gather together and interpret the significance of existing data, particularly as it related to describing the cumulative effects of effluents arising from development on the aquatic environment. The different facets of this project included: identification of effluent sources, characterization of effluent arising from municipal and non-pulp mill industry sources, preparation of two annotated bibliographies, and three synthesis reports. The two bibliographies were distinct products that supported the preparation of two synthesis reports dealing with contaminants and ecotoxicity of pulp mill effluents.

This report presents the annotated bibliography on contaminants. The bibliography was intended to focus on databases dealing with chemical and microbiological contaminants existing in the aquatic environment and the potential impacts - ecotoxicological effects of these contaminants on aquatic ecosystems. The subsequent synthesis report, which was not completed, was to dwell on: a comparison of findings to present trends in effluent quality / quantity, presentation of summary statistics on the types and levels of contaminants present, a discussion of ecotoxicological significance, including human health, of contaminants and their concentration, an assessment of the significance of the presence, concentration and distribution of contaminants found in the aquatic environment, a discussion of water quality guidelines and objectives, information gaps and areas requiring monitoring.

The annotated bibliography covers all information on instream contaminants on the Athabasca, Peace and Slave rivers. It was completed on dBase IV and is presented in printed and electronic versions, the latter can be used to electronically search for specific subjects by key words.

REPORT SUMMARY

This document is an annotated bibliography of government and industrial reports and databases pertaining to chemical and microbial contaminants existing in the water, sediment and biota of the Peace, Athabasca and Slave rivers in Alberta and the Northwest Territories. Key journal articles pertaining to contaminants from industries, particularly pulp mills, have been included because of their relevance even though the articles may refer to studies outside of northern Alberta.

ACKNOWLEDGEMENTS

SENTAR would like to acknowledge the assistance of the NRBS and the co-operation of Alberta Environmental Protection, Environment Canada and the pulp mills. In particular, we would like to thank Dr. Fred Wrona, Dr. Patricia Chambers and Greg Wagner who made the majority of the documents available to us through this and earlier contracts.

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 OBJECTIVE

In January 1993, SENTAR Consultants Ltd. (SENTAR) was authorized by the Northern River Basins Study (NRBS) to compile and review water quality and related data pertaining to contaminants found in the ambient aquatic environment within the specific study area. The project consists of three parts: data collection, a synthesis report, and an annotated bibliography.

The objective of the annotated bibliography is to identify and annotate the available databases, government and industry reports, journal papers, and other sources of information on chemical and microbial contaminants existing in the aquatic environment (water, sediment, biota) and potential impacts and ecotoxicological effects of these contaminants to aquatic ecosystems. Instream contaminant concentrations and loading, bioaccumulation, and the toxicity of contaminants on aquatic biota within the three northern rivers of the study are to be addressed.

1.2 SCOPE

The study area includes the Peace, Athabasca and Slave rivers within Alberta and the Northwest Territories (Figure 1 Northern River Basins Study Area). The study includes major tributaries to the three rivers; for example, the evaluation of the Peace River will include the Wapiti River-Smoky River system. The Lesser Slave River is a major tributary to the Athabasca River.

The annotated bibliography pertaining to contaminants is similar to two other annotated bibliographies prepared for the NRBS on related topics, including ecotoxicity of pulp mill effluents and nutrient loadings on the Athabasca, Peace and Slave rivers. Essentially, this bibliography covers all information on instream contaminants; industrial and municipal point source loadings are addressed by other reports and bibliographies.

The bibliography was completed on dBase IV. By using this database, topics can be searched electronically by key words. To assist users, SENTAR Consultants Ltd. has supplied the contaminants bibliography in both printed version and electronic disc. The other bibliographies have been prepared in the same format on dBase IV.

References pertaining to relevant studies conducted within the NRBS study area have been annotated (Appendix A). In some cases, these reports listed secondary sources of information which have also been included in an appendix to this bibliography (Appendix B), but have not been annotated. SENTAR considers the references in Appendix B are outside the scope of this assignment. These un-annotated references were included to give the reader the original sources of information used in the preparation of the annotated reports. Also included in this document are the annotations of major review papers dealing with contaminants and their ecotoxicity. Emphasis was placed on research which has made a significant contribution to the development of present-day knowledge.

SENTAR

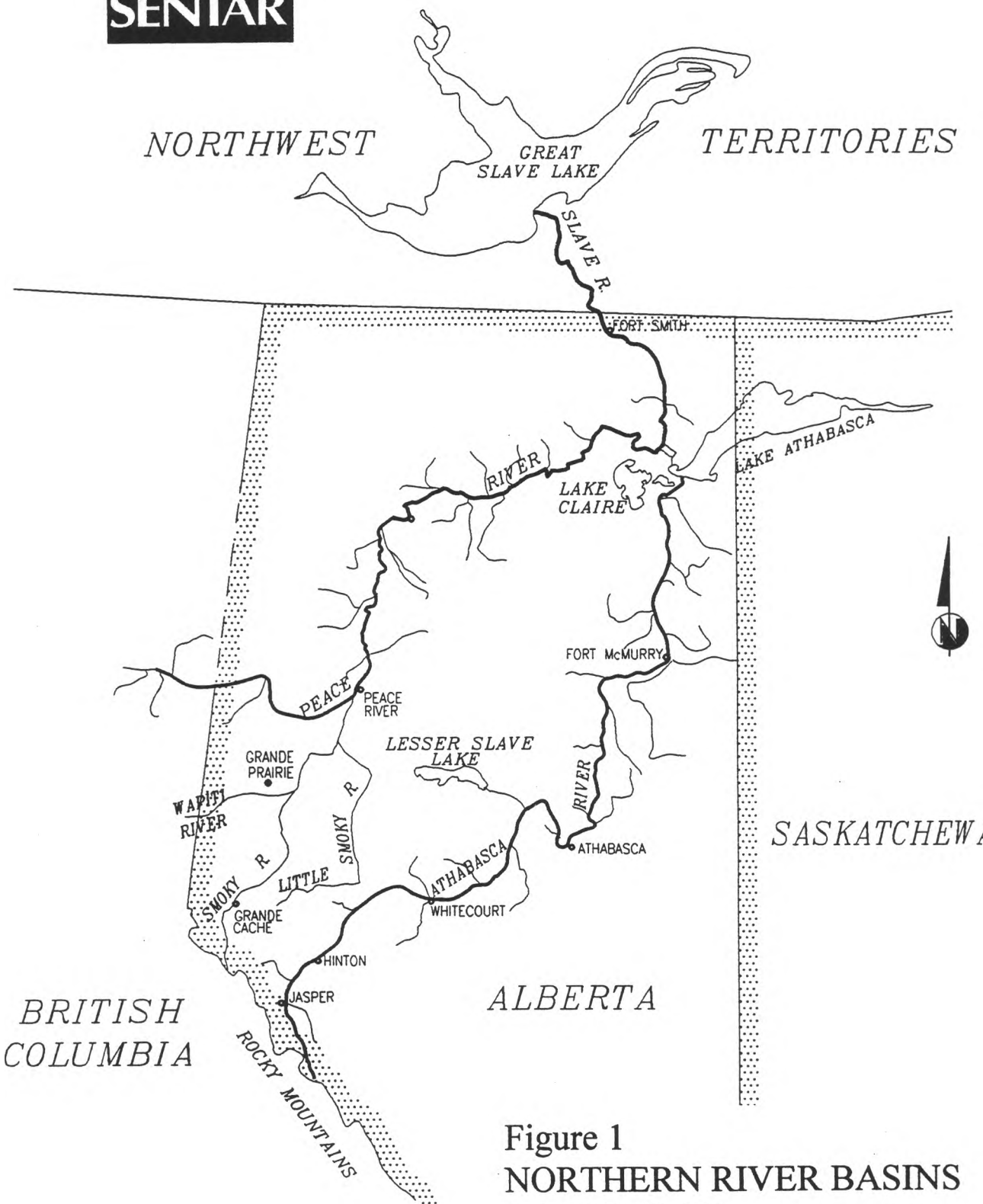

Figure 1
NORTHERN RIVER BASINS
STUDY AREA

13-089-31-04

2.0 USER'S INFORMATION

2.1 ORGANIZATION

The annotated bibliography is arranged alphabetically by author, then by date of publication. As much information as possible was included in each bibliography to provide users with several options when searching for a report or group of related reports.

The annotated bibliography is organized as follows:

AUTHOR	The name of author(s) or organizations who prepared the report.
DATE	The year in which the report was published.
DUP_DATE	A lower-case letter identifying the report from other reports published by the same author in the same year.
TITLE	The report title.
OTHER1	The name of client(s) for whom the report was prepared.
PUBLISHER	The name of the publisher or the name of the journal/publication, the volume number and the pages.
OTHER2	Additional information such as project number, detailed date, report length and appendices.
ANNOTATION	A note explaining the contents of the report. When the annotation is not original, the source of the annotation is cited.
KEY	Key word fields identifying the topics covered.

This annotated bibliography is comprised of reports pertaining to contaminants; it is a subset of a larger bibliography. For this reason, the duplicate dates (e.g. Smith 1991a, 1991c) listed for the same author and year may not be consecutive if a report with the same author and year (e.g. Smith 1991b) pertains to another topic (e.g. nutrients) within the larger bibliography.

2.2 KEY WORD FIELDS

2.2.1 Summary of Key Word Field Names

Five general categories of information were identified. Key word fields were defined for each of these five information categories (Table 1 Information Categories and Key Word Field Names). Ten "key word" fields have been created. Each field contains one or more key words.

Table 1: Information Categories and Key Word Field Names

INFORMATION TYPE	FIELD NAME
1. Location	
(a) Waterbody/Basin	KEY_WATER
(b) Geographic Descriptors	KEY_GEOG
2. Physical, Chemical and Toxicological Parameters	KEY_PARAM
3. Biota	
(a) Animals	KEY_ANIMAL
(b) Plants	KEY_PLANT
(c) Microbes	KEY_MCROBE
4. Sampling Media	KEY_MEDIA
5. Miscellaneous	KEY_MISC1
	KEY_MISC2
	KEY_MISC3

2.3 EXPLANATION OF KEY WORD FIELDS

2.3.1 Waterbody/Basin

Key Word Field: KEY_WATER

Key Words:

ATHABASCA	MACKAY	PEMBINA
BEAVER	MACKENZIE	RED DEER
BOW	MCLEOD	SLAVE
CLEARWATER	MUSKEG	SMOKY
FRASER	NORTH SASKATCHEWAN	SOUTH SASKATCHEWAN
HARTLEY	OLDMAN	STEEPBANK
LAKE SUPERIOR	PEACE	THOMPSON
LESSER SLAVE	PEACE-ATHABASCA	WAPITI

Words entered into this field define the water body(s) referred to in a document. Zero to many waterbodies may be listed. All of the main rivers in the Northern River Basins and their tributaries are eligible for this field. In cases where waterbodies outside of the Northern River Basins are discussed, they are also listed. The key words do not indicate waterbody type; that is, they do not designate if the waterbody is a river, lake, reservoir, etc. These designations are found in the miscellaneous key word field(s).

Some of the key words in this field appear to be redundant. For example, both "Athabasca" and "Peace-Athabasca" are used. This is done to accommodate searching strategies. For example, "Athabasca" is listed to capture documents on the Athabasca River, or on the Athabasca Basin. "Peace-Athabasca" is listed to capture documents pertaining to the Peace-Athabasca Delta.

2.3.2 Geographic Descriptors

Key Word Field: KEY_GEOG
Key Words:

ALBERTA	EMBARRASS	ONTARIO
ATHABASCA	FORT CHIPEWYAN	OREGON
BENNETT DAM	FORT MCMURRAY	PEACE RIVER
BRITISH COLUMBIA	GRANDE PRAIRIE	SLAVE LAKE
CANADA	HINTON	WHITECOURT
	NORTHWEST TERRITORIES	

In some cases, it is useful to describe the location of the study in geographic terms other than the name of a waterbody/basin. This field defines political boundaries and specific locations (e.g. municipalities).

2.3.3 Physical, Chemical and Toxicological Parameters

Key Word Field: KEY_PARAM
Key Words:

CHLORINATED ORGANIC(S)	NUTRIENT(S)	OXYGEN DEMAND
EXTENSIVE	ORGANIC(S)	PHYSICAL PARAMETER(S)
METAL(S)	OXYGEN	TOXIC
NON-METAL INORGANIC(S)		

The terms listed in Table 2 Information Categories and Key Words in "Key_Parameter" Field were chosen to categorize different types of parameters, including those specifically related to contaminants.

Table 2: Information Categories and Key Words in "Key_Parameter" Field

KEY WORD	WATER QUALITY PARAMETERS
Chlorinated Organics:	- dioxins - furans - chlorinated phenols - other
Extensive:	- broad spectrum survey - more than two categories
Metals:	- all metals
Non-Metal Inorganics:	- major ions - halides - arsenic, etc.
Nutrients:	- nitrogen - phosphorous
Organics:	- non-chlorinated organics - petroleum (e.g. oil)
Oxygen:	- dissolved oxygen
Oxygen Demand:	- biochemical oxygen demand (BOD) - chemical oxygen demand (COD) - sediment oxygen demand (SOD)
Physical Parameters:	- temperature - alkalinity - hardness - pH - conductivity - odour - colour - total suspended solids (filterable residue) - total dissolved solids (non-filterable residue)
Toxic:	- toxicity of contaminants

2.3.4 Animals

Key Word Field:	KEY_ANIMAL	
Key Words:	FAUNA	VERTEBRATE
	INVERTEBRATE	

This field indicates whether a document contains information about invertebrates, vertebrates or fauna in general. The term "fauna" is a generic term for those documents that are not specific about the animal(s) that are being discussed. Because these terms are so broad, further identification of the animal may be found in the miscellaneous key word field. For example, if a document refers to a study on the effects of contaminants on fish, the key word for this field will be vertebrates. And, in the KEY_MISC field, "fish" will be listed. (Note: the ANNOTATION field may also contain the term "fish").

2.3.5 Plants

Key Word Field:	KEY_PLANT	
Key Words:	ALGAE	FLORA
	CHLOROPHYLL	MACROPHYTE

This field indicates whether a document contains information about plants. The same principles apply for this field, as for the KEY_ANIMAL field.

2.3.6 Microbes

Key Word Field:	KEY_MCROBE	
Key Words:	BACTERIA	MICROBE
	FUNGI	

This field indicates whether a document contains information about microscopic biota: bacteria (total coliform, fecal coliform, fecal streptococci), fungi or viruses.

2.3.7 Sampling Media

Key Word Field:	KEY_MEDIA	
Key Words:	BIOTA	SEDIMENT
	EFFLUENT	WATER

The type of sample that has been analyzed is identified by these key words.

2.3.8 Miscellaneous

Key Word Fields: KEY_MISC1, KEY_MISC2, KEY_MISC3

Key Words:

ALBERTA-PACIFIC
ANNUAL REPORT
ANC
BASELINE
BASIN
BENTHOS
BIBLIOGRAPHY
BIOACCUMULATION
CONTAMINANT
DAISHOWA
DATABASE
DELTA
DIOXINS
ECOLOGY
ECOSYSTEM
EFFLUENT
EIA
EXPERIMENT
FATE
FISH
FOOD CHAIN
FOREST HARVESTING
FURANS
GENERAL REFERENCES
GEOLOGY
HINTON
HUMAN HEALTH
HYDROLOGY
IMPACT
INDUSTRY
INVENTORY
INVESTIGATION
LAKE
LICENCE
METHODS
MILLAR WESTERN
MINING
MODEL
MONITORING
NAQUADAT
NUTRIENT
OIL
OIL SANDS
ORGANOCHLORINE
POLLUTION
PROCTER & GAMBLE
PULP MILL
REPRODUCTION
RIVER
SALMONID
SAMPLING
SEWAGE TREATMENT
SLAVE LAKE
SPILL
STUDIES
SUNCOR
SURVEY
SYNCRUDE
WATER QUALITY
WATER RESOURCES
WATER USE
WELDWOOD

The key words used to compile the annotated bibliography relating to contaminants were not placed in specific key word fields because the key words relating to this topic were too numerous. Creating key word fields for each relevant key word would have increased the level of complexity of the bibliography beyond a practical level. Instead, the selection of appropriate key words was left in the miscellaneous key word fields. This will allow the searcher to select the most relevant search criteria, depending on the topic in question. As the field name suggests, these key words are miscellaneous terms that help to describe a document and/or to refine the definition of a key word from another field. For example, if a document describes a study about the levels of oil in a river, and the key word "ORGANICS" is listed in KEY_PARAM1, then to narrow the description of the document further, "OIL" would be listed in KEY_MISC1.

2.4 dBase FILE INFORMATION

The annotated bibliography was designed using dBase IV. The database file name is CONTAMNT.dbf and is accompanied with a file named CONTAMNT.dbt. The .dbt extension refers to data contained in the memo field. The .dbt file must accompany the .dbf file.

Indices created during the use of the database will have an .mdx extension. When backing up files or transferring to other disks, it is important that all .dbf, .dbt and .mdx files are copied. When performing a search, the words selected must be in uppercase. It is advisable to use a "wild card" extension when searching key words that may or may not be pluralized (Example: INVERTEBRATE*, METAL*). Often, a field may have several key words. When searching for one key word in a list of several, place the key word in quotation marks preceded by a "$" sign (e.g. $"WORD"). This tells dBase that the character

string being searched is imbedded. Multiple key words and multiple fields can be searched at the same time. Several key words can be searched in one field, as long as each key word is on a separate line. Put each word on a separate row (one beneath the other) in the Query definition screen. By doing this, dBase will search for records containing any or all of the key words. The above rules apply (e.g. uppercase, $ and quotation marks for imbedded strings, and separate lines for each key word). The following example illustrates this:

KEY_XX	**KEY_YY**	**KEY_ZZ**
$"WORD1"		
$"WORD2"		
	$"WORD3"	
	$"WORD4"	
		"WORD5"

The "WORD5" example shown above illustrates a case where only one key word would be found in that field, as opposed to a list of key words.

3.0 ANNOTATED BIBLIOGRAPHY

The annotated bibliography which follows in Appendix A consists of "158" annotated references from government and industry reports, scientific papers and other print sources. References cited in the reports have been retained in Appendix B. The major databases containing data on contaminants can be found in Appendix C. A copy of the terms of reference have been included in Appendix D.

APPENDIX A

ANNOTATED BIBLIOGRAPHY FROM PRINTED (HARD COPY) SOURCES

AUTHOR	Akena, A.M.
DATE	1980
DUP_DATE	
TITLE	Water Quality of Athabasca Oil Sands Area. Vol. 1. Data Collection and Quality.
OTHER1	For Alberta Oil Sands Environmental Research Program.
PUBLISHER	Alberta Environment, Pollution Control Division. Project W.S. 1.2.1.
OTHER2	August 1980; 71 pp.
ANNOTATION	"This report documents locations of Athabasca Oil Sands Area sampling sites, sampling analytical and quality control methods, and availability of assembled data, and provides an appraisal of the data base" (cited from McGregor and Cary, 1991).

KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	EXTENSIVE
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	WATER QUALITY, SAMPLING, METHODS, RIVER, OIL SANDS
KEY_MISC2	
KEY_MISC3	

AUTHOR	Akena, A.M. and L.L. Christian.
DATE	1981
DUP_DATE	
TITLE	Water Quality of the Athabasca Oil Sands Area. Vol. 4. An Interim Compilation of Non-AOSERP Water Quality Data.
OTHER1	For Alberta Oil Sands Environmental Research Program.
PUBLISHER	Alberta Environment, Pollution Control Division.
OTHER2	October 1981; 242 pp.
ANNOTATION	"This report assembles non-AOSERP water quality data dating back to the 1950's without validating or evaluating it" (cited from McGregor and Cary, 1991).
KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	EXTENSIVE
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	WATER QUALITY, RIVER, DATABASE, OIL SANDS
KEY_MISC2	
KEY_MISC3	

AUTHOR	Alberta Environment Library.
DATE	1992
DUP_DATE	
TITLE	A Computer-Retrieved Bibliography from the SciTech Database: Northern Rivers & Pulp and Paper Operations.
OTHER1	Requested by: M. Bhatnagar for P. Chambers, National Hydrology Research Centre, Saskatoon, Saskatchewan.
PUBLISHER	Alberta Environment.
OTHER2	
ANNOTATION	The SCITECH database is a joint listing of books/reports held in 3 Alberta Government libraries: Alberta Environment, Alberta Agriculture, Alberta Research Council. The collection covers a wide range of scientific and technical subjects. Search terms used for this data search are: Set 1 - Wapiti, Athabasca, Peace, Smoky and Set 2 - pulpwood, wood-pulp, pulp mills, water pollution, paper, water quality.
KEY_WATER	WAPITI, ATHABASCA, PEACE, SMOKY
KEY_GEOG	ALBERTA
KEY_PARAM	
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	PULP MILL, RIVER, WATER QUALITY, DATABASE, POLLUTION
KEY_MISC2	
KEY_MISC3	

AUTHOR	Alberta Environment.
DATE	1979
DUP_DATE	
TITLE	Athabasca River Basin Data Compilation: Vol. II.
OTHER1	
PUBLISHER	Planning Division, Alberta Environment.
OTHER2	
ANNOTATION	"The basin is divided into the following sub-basin: Berland River, Lac La Biche River, McLeod River, Lesser Slave Lake and River. Data was assembled for Geology, Hydrology, Hydrogeology, and Hydrometeorology, Land Use, Water Use, Water Quality, Environmental consideration, Fisheries, Wildlife, Recreation Demography, Physical Resources, Archaeology and Water Resources Management" (cited from McGregor and Cary, 1991).
KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	
KEY_MISC1	WATER QUALITY, HYDROLOGY, BASIN, WATER USE, WATER RESOURCES
KEY_MISC2	
KEY_MISC3	

AUTHOR	Alberta Environment.
DATE	1981
DUP_DATE	
TITLE	Peace River Basin - An Overview of Water Resource Planning Needs.
OTHER1	
PUBLISHER	Planning Division, Alberta Environment.
OTHER2	January 1981.
ANNOTATION	"This overview presents water resource management concerns that have been noted in the past and are anticipated in the future. Seven major findings and four major recommendations were produced by the report. The findings dealt with concerns related to water quantity and quality, hydroelectric potential and drainage. A major recommendation was that planning needs to concentrate on two areas: long-term future supply/demand; and institutional and program aspects" (as cited in McGregor and Cary, 1991).
KEY_WATER	PEACE
KEY_GEOG	ALBERTA
KEY_PARAM	
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	WATER QUALITY, BASIN, RIVER, WATER RESOURCES, WATER USE
KEY_MISC2	
KEY_MISC3	

AUTHOR	Alberta Environment.
DATE	1985
DUP_DATE	
TITLE	Slave River Basin Overview.
OTHER1	
PUBLISHER	Environmental Assessment Section, Planning Services Branch, Planning Division, Alberta Environment.
OTHER2	
ANNOTATION	"This report provides an inventory of existing information pertaining to geology, soils, vegetation, climate, fish, wildlife, and land use of the basin as well the water quality and hydrology of the Slave River; critical areas for fish and wildlife and unique features of the Salt River Sub-basin" (cited from McGregor and Cary, 1991).
KEY_WATER	SLAVE
KEY_GEOG	ALBERTA
KEY_PARAM	
KEY_ANIMAL	FAUNA
KEY_PLANT	FLORA
KEY_MCROBE	
KEY_MEDIA	
KEY_MISC1	RIVER, WATER QUALITY, HYDROLOGY, FISH
KEY_MISC2	
KEY_MISC3	

AUTHOR	Alberta Environment.
DATE	1986
DUP_DATE	
TITLE	Athabasca River Basin Study - Water Quality Component - Athabasca River Basin Industrial Effluent Discharges.
OTHER1	
PUBLISHER	Athabasca River Basin Section, Planning Division, Alberta Environment.
OTHER2	
ANNOTATION	"This report summarizes information on licensed industrial liquid discharges in the Athabasca River Basin, including type of industrial operation, discharge route, liquid source, estimated discharge volume and management monitoring required for the license" (cited from McGregor and Cary, 1991).
KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, EFFLUENT
KEY_MISC1	WATER QUALITY, RIVER, EFFLUENT, LICENCE, INDUSTRY, BASIN, MONITORING, DATABASE
KEY_MISC2	
KEY_MISC3	

AUTHOR	Alberta Environment.
DATE	1990
DUP_DATE	a.
TITLE	Alberta Water and Wastewater Facilities Survey, 1990.
OTHER1	
PUBLISHER	Environmental Protection Services, Standards and Approvals Division, Municipal Branch, Edmonton, Alberta.
OTHER2	
ANNOTATION	This document is a listing of municipal water and wastewater systems in the Province of Alberta. It summarizes information on municipally-owned systems and non-municipally owned facilities that are subject to inspection by the Municipal Branch. Included in the non-municipally owned facilities are mobile home parks, schools, Hutterite colonies, subdivisions, national and provincial parks, and other sites (industrial parks, airports, etc.). Data are listed with drainage route information and include locations along the Athabasca River near Whitecourt.
KEY_WATER	ATHABASCA
KEY_GEOG	WHITECOURT, ALBERTA
KEY_PARAM	
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, EFFLUENT
KEY_MISC1	LICENCE, EFFLUENT, SEWAGE TREATMENT
KEY_MISC2	
KEY_MISC3	

AUTHOR	Alberta Environment.
DATE	1990
DUP_DATE	b.
TITLE	Dioxin and Furan Testing in Fish from the Athabasca and Wapiti Rivers: Results and Health Advisory Released by Federal and Provincial Governments.
OTHER1	
PUBLISHER	Forestry, Lands and Wildlife, Alberta Environment, Edmonton, Alberta.
OTHER2	July 1990. 15 pp.

ANNOTATION Alberta Forestry, Lands and Wildlife (July 27, 1990) issued a fish consumption advisory for the Athabasca, Wapiti and Smoky river systems. This provincial advisory is in response to the official release of the Health and Welfare Canada dioxin and furan test results for fish near Alberta kraft pulp mills. Fish consumption guidelines are recommended for selected fish species in the Athabasca and Wapiti rivers. Some consumption guidelines applied to tributary streams of these rivers because of the migratory nature of affected fish....Fish consumers were advised to check with local fish and wildlife offices to ensure that the guidelines were clearly understood.

KEY_WATER	ATHABASCA, WAPITI
KEY_GEOG	ALBERTA
KEY_PARAM	TOXIC, CHLORINATED ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	BIOTA
KEY_MISC1	ORGANOCHLORINE, RIVER, PROCTER & GAMBLE, ANC, MILLAR WESTERN, PULP MILL, WATER QUALITY, DIOXINS
KEY_MISC2	FURANS
KEY_MISC3	

AUTHOR	Alberta Environment.
DATE	1993
DUP_DATE	
TITLE	Nutrient Data, Northern Rivers Study Area.
OTHER1	
PUBLISHER	Environmental Assessment Division, Environmental Protection Services, Alberta Environment.
OTHER2	
ANNOTATION	This is a collection of data provided by Alberta Environment on 1) nutrient data file descriptions, 2) Athabasca River sample sites, 3) a list of Peace/Athabasca/Slave government water quality background reports, 4) LTRN and MTRN sites in Northern Alberta, and 5) Alberta Environment water quality data, nitrogen and phosphorus. Forms of nutrients include particulate nitrogen, dissolved nitrogen, particulate kjeldahl nitrogen, nitrate nitrogen, nitrite/nitrate nitrogen, total ammonia nitrogen, total phosphorus, dissolved inorganic phosphorus, and total inorganic phosphorus.
KEY_WATER	ATHABASCA, PEACE, SLAVE
KEY_GEOG	ALBERTA
KEY_PARAM	NUTRIENTS
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	NUTRIENT, BIBLIOGRAPHY, RIVER, WATER QUALITY, MONITORING, DATABASE
KEY_MISC2	
KEY_MISC3	

AUTHOR	Alberta Environment.
DATE	n.d.
DUP_DATE	
TITLE	Athabasca River Basin Study - Overview.
OTHER1	
PUBLISHER	Alberta Environment, Planning Division.
OTHER2	October 1982; 345 pp.

ANNOTATION "This report is a comprehensive inventory of the existing information on natural resources, and natural resources issues, in the basin. Included are 23 chapters dealing with land use, water quantity and quality issues, climate, geology, mineral resources, fish and wildlife resources to name a few. No definitive conclusions were made" (cited from McGregor and Cary, 1991).

KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	EXTENSIVE
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	BASIN, WATER QUALITY, FISH, INVENTORY, BIBLIOGRAPHY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Alberta Environmental Centre.
DATE	1984.
DUP_DATE	
TITLE	Methoxychlor and 2,2-Bis (P-Methoxyphenyl)-1, 1-Dichloroethylene Residues in Fish in Alberta.
OTHER1	
PUBLISHER	Alberta Environmental Centre, Vegreville, Alberta.
OTHER2	AECV 84-R1. 24 pp.
ANNOTATION	"Between 1980 and 1983, a total of 1284 fish were collected from 15 major lakes and rivers in Alberta for analysis of methoxychlor (MEO-DDT) and its lipophilic metabolite 2,2-bis(p-methoxyphenyl)-1, 1-dichloroethylene (MEO-DDE). Analysis was conducted on both edible muscle and intestinal fat" (as cited in document).
KEY_WATER	ATHABASCA, NORTH SASKATCHEWAN, BEAVER, WAPITI, BOW, SOUTH SASKATCHEWAN, OLDMAN, RED DEER, SMOKY
KEY_GEOG	ALBERTA
KEY_PARAM	CHLORINATED ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	FISH, FATE, CONTAMINANT, STUDIES, SAMPLING, MONITORING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Alberta Environmental Centre.
DATE	1987.
DUP_DATE	
TITLE	Toxicity and Environmental Chemistry of Wastewater from a Kraft Pulp and Paper Mill: Fish Toxicity Studies.
OTHER1	Report AECV87-R4.
PUBLISHER	Alberta Environmental Centre.
OTHER2	67 pp.
ANNOTATION	"The purpose of this investigation was to determine if effluent discharged from the Procter & Gamble Cellulose Ltd. (Grande Prairie) kraft process pulp and paper mill was deleterious to fish in the Wapiti River. The presence and concentrations of organic and inorganic chemicals in effluent, river water and selected fish tissues were determined. In addition, selected tissues from fish resident in the river adjacent to the mill were examined for evidence of pathological changes....The results reported herein represent a more in-depth assessment of water and effluent chemistry than is normally carried out for monitoring purposes" (cited from document abstract).
KEY_WATER	WAPITI
KEY_GEOG	GRANDE PRAIRIE, ALBERTA
KEY_PARAM	TOXIC, ORGANICS, METALS, PHYSICAL PARAMETERS, OXYGEN DEMAND, NON-METAL INORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA, EFFLUENT
KEY_MISC1	PULP MILL, EFFLUENT, FISH, FATE, CONTAMINANT, NUTRIENT, SAMPLING, STUDIES
KEY_MISC2	
KEY_MISC3	

AUTHOR Allan, R.J. and T.A. Jackson.
DATE 1978.
DUP_DATE
TITLE Heavy Metals in Bottom Sediments of the Mainstem Athabasca River System in the AOSERP Study Area.
OTHER1 Prepared for the Alberta Oil Sands Environmental Research Program.
PUBLISHER Fisheries and Environment Canada, Freshwater Institute.
OTHER2 AOSERP Report 34. 72 pp.

ANNOTATION Dredged sediments and sediment cores were collected from sites along the Athabasca River system from between Fort McMurray and the confluence of Riviere des Rochers with the Slave River. A selected sample suite representing all of the drainage units and textural variations was analysed by several total and partial element extraction techniques. Sediment samples were collected during late August to early September 1976.

The first general objective of this study was to provide baseline information on the historic concentrations of heavy metals in the bottom sediments of the different components (river, delta, lake) of the mainstem Athabasca River system. The second general objective was to employ selective dissolution analyses (SDA) and measurement of other sedimentological and minerological parameters to better understand the forms in which these heavy metals occur in the bottom sediments. Specific objectives were: 1. to determine concentration and distribution of various heavy metals in the bottom sediments from just above Fort McMurray to the Slave River confluence; 2. to comment on the historic input of metals to the drainage system and on any detected contamination; 3. to use selective SDA to develop a better understanding of the forms in which heavy metals are held in the bottom sediments; 4. to recommend any necessary continuation of bottom sediment collection and analysis so as to monitor toxic metal impact on the mainstem Athabasca River of extraction and processing of the Athabasca Oil Sands.

KEY_WATER ATHABASCA, SLAVE
KEY_GEOG FORT MCMURRAY, ALBERTA
KEY_PARAM METALS, TOXIC
KEY_ANIMAL
KEY_PLANT
KEY_MCROBE
KEY_MEDIA SEDIMENT, WATER

KEY_MISC1 RIVER, OIL SANDS, SAMPLING, HYDROLOGY, CONTAMINANT, FATE, BASELINE, INVENTORY

KEY_MISC2

KEY_MISC3

AUTHOR	Anderson, A.M.
DATE	1989.
DUP_DATE	
TITLE	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.
OTHER1	
PUBLISHER	Environmental Quality Monitoring Branch, Environmental Assessment Division, Alberta Environment.
OTHER2	December 1989. 205 pp.

ANNOTATION

"This document combines the results of two survey programs carried out between 1984 and 1986 on the upper Athabasca River. It evaluates the effects of the combined pulp mill and municipal effluent discharges at Hinton on the zoobenthic community during spring 1984 and fall 1985, and on physical/chemical water quality during low flow conditions in fall 1985 and winter 1986" (cited from document).

Water quality parameters measured include nutrients, physical characteristics, non-metal inorganics, oxygen, oxygen demands, organics, bacteria and chlorophyll. Mass loadings are reported for various constituents in effluent (kg/d and R.U./d). NAQUADAT analytical method codes are provided.

KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA, HINTON
KEY_PARAM	EXTENSIVE
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	CHLOROPHYLL
KEY_MCROBE	BACTERIA
KEY_MEDIA	WATER, EFFLUENT, BIOTA
KEY_MISC1	WELDWOOD, PULP MILL, EFFLUENT, NAQUADAT, NUTRIENT, RIVER, SEWAGE TREATMENT, WATER QUALITY, BENTHOS
KEY_MISC2	
KEY_MISC3	

AUTHOR	Anonymous.
DATE	1992
DUP_DATE	a.
TITLE	Northern River Basins Study Status Report on Companion Studies.
OTHER1	October 20, 1992. 15 pp.
PUBLISHER	
OTHER2	

ANNOTATION This report reviews some known sources of studies as well as parallel studies that are relevant to the Northern River Basins Study and that are available to coordinators of and specialist contributors to the Northern River Basins Study.

KEY_WATER	PEACE, ATHABASCA, SLAVE, WAPITI, SMOKY, LESSER SLAVE, MACKENZIE
KEY_GEOG	ALBERTA, BRITISH COLUMBIA
KEY_PARAM	TOXIC, OXYGEN, ORGANICS, CHLORINATED ORGANICS
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	SEDIMENT, WATER
KEY_MISC1	BIBLIOGRAPHY, PULP MILL, BASIN, MONITORING, CONTAMINANT
KEY_MISC2	FOOD CHAIN, REPRODUCTION, FISH
KEY_MISC3	

AUTHOR	Anonymous.
DATE	1992
DUP_DATE	b.
TITLE	List of Aquatic Environment Studies by Alberta Pulp and Paper Mills.
OTHER1	
PUBLISHER	
OTHER2	
ANNOTATION	A list of environmental studies categorized by pulp mill: 1) Peace River Pulp, 2) Slave Lake Pulp, 3) Millar Western Pulp, 4) Alberta Newsprint Company, and 5) Procter & Gamble Cellulose.
KEY_WATER	ATHABASCA, WAPITI, PEACE, SMOKY, MCLEOD, SLAVE
KEY_GEOG	ALBERTA, WHITECOURT, GRANDE PRAIRIE, HINTON, PEACE RIVER, SLAVE LAKE
KEY_PARAM	TOXIC, ORGANICS, PHYSICAL PARAMETERS, METAL, NON-METAL INORGANICS, OXYGEN DEMAND, OXYGEN
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA, SEDIMENT
KEY_MISC1	BIBLIOGRAPHY, DAISHOWA, EFFLUENT, FISH, BIOACCUMULATION, MONITORING, BENTHOS, SLAVE LAKE, ANC
KEY_MISC2	ORGANOCHLORINE, PULP MILL, RIVER, SAMPLING, WATER QUALITY, PROCTER & GAMBLE, MILLAR WESTERN
KEY_MISC3	

AUTHOR	Aquatic Environments Ltd.
DATE	1981
DUP_DATE	
TITLE	Chemical and Biological Monitoring of Muskeg Drainage at the Alsands Site: Vol. III Program Evaluation and Suggestions for Continued Monitoring.
OTHER1	
PUBLISHER	Alsands Energy Ltd.
OTHER2	

ANNOTATION "This report describes suggestions for continued aquatic biomonitoring that apply specifically to the Muskeg drainage, but can serve as a guide for monitoring other rivers of a similar nature in the AOSERP area. There are few, if any, universally accepted monitoring methods for aquatic biota, and those suggested in the report are those that were found useful in Alsands 1980 studies.

This report also discusses impacts, mitigation measures, monitoring parameters and methods, water quality, biological parameters, benthic invertebrates, periphytic algae, data storage and retrieval and preliminary studies" (cited from McGregor and Cary, 1991).

KEY_WATER	ATHABASCA, MUSKEG
KEY_GEOG	ALBERTA
KEY_PARAM	
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	RIVER, BASIN, MONITORING, OIL, WATER QUALITY, BENTHOS
KEY_MISC2	
KEY_MISC3	

AUTHOR	Aquatic Environments Ltd.
DATE	1982
DUP_DATE	
TITLE	Spawning and Distribution of Lake Whitefish (Coregonus clupeaformis) in Athabasca River and Lake Athabasca.
OTHER1	Prepared for Alberta Environment.
PUBLISHER	Planning Division, Alberta Environment.
OTHER2	April 1982. 38 pp. + Appendices.
ANNOTATION	"This report describes one of the fisheries studies conducted in the vicinity of an ice-control structure proposed for the Athabasca River upstream of Fort McMurray. The area is important for Lake Whitefish spawning. The concern is about fish that reside most of their lives in Lake Athabasca and migrate upstream in late summer to spawn in this area. The major objective of the study is to determine the areas of Lake Athabasca which the fish frequent during the period of lake residence. The study takes into consideration water quality, movements and distribution of fish in the study area, spawning period, distribution of eggs, abundance of spawners, re-captures of tagged fish, separation of river and lake spawning fish and distribution of river spawners in Lake Athabasca" (as cited in McGregor and Cary, 1991).
KEY_WATER	ATHABASCA
KEY_GEOG	FORT MCMURRAY, ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	FISH, WATER QUALITY, LAKE, REPRODUCTION
KEY_MISC2	
KEY_MISC3	

AUTHOR	Aquatic Environments Ltd./Hardy Assoc. Ltd.
DATE	1981
DUP_DATE	
TITLE	Chemical & Biological Monitoring of Muskeg Drainage at the Alsands Site - Vol. II - Fish Studies.
OTHER1	
PUBLISHER	Alberta Environment and Alsands Energy Ltd.
OTHER2	
ANNOTATION	The main objective of this report is "to study the effect of drainage in the Muskeg River Basin on biological communities. Drainage from the mine site ditch reduced the biomass of periphelegic algae but increased the circumstance of certain invertebrates and predators a short distance below the outfall. Only algae biomass on glass showed evidence of environmental impact for downstream" (cited from McGregor and Cary, 1991).
KEY_WATER	ATHABASCA
KEY_GEOG	FORT MCMURRAY, ALBERTA
KEY_PARAM	
KEY_ANIMAL	INVERTEBRATE, VERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	BIOTA
KEY_MISC1	RIVER, FISH, IMPACT
KEY_MISC2	
KEY_MISC3	

AUTHOR	Barton, D.R. and R.R. Wallace.
DATE	1979
DUP_DATE	a.
TITLE	The Effects of an Experimental Spillage of Oil Sands Tailings Sludge on Benthic Invertebrates.
OTHER1	
PUBLISHER	Environ. Pollut. 18:305-312.
OTHER2	
ANNOTATION	A minor (0.11 m3) instantaneous spillage of oil sands tailings sludge was introduced to a 30 m reach of the Muskeg River about 1 km above its confluence with the Athabasca River on 2 October 1976. Benthic samples were collected with a scoop. Loss on ignition, grain size, total organic carbon, and oil and grease analyses were done on the sludge.
KEY_WATER	MUSKEG, ATHABASCA
KEY_GEOG	FORT MCMURRAY, ALBERTA
KEY_PARAM	TOXIC, ORGANICS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	BIOTA, WATER
KEY_MISC1	OIL, SPILL, BENTHOS, STUDIES, IMPACT, SAMPLING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Barton, D.R. and R.R. Wallace.
DATE	1979
DUP_DATE	b.
TITLE	Effects of Eroding Oil Sand and Periodic Flooding on Benthic Macroinvertebrate Communities in a Brown-Water Stream in Northeastern Alberta, Canada.
OTHER1	In Canadian Journal of Zoology 57(3): 533-541.
PUBLISHER	National Research Council of Canada.
OTHER2	
ANNOTATION	A portion of the Steepbank River, a tributary of the Athabasca River which cuts through the Athabasca oil sands deposit, was studied seasonally in 1976 and 1977. Benthic invertebrates were sampled above and within the oil sands deposit. Substrate and flooding were examined.
KEY_WATER	STEEPBANK, ATHABASCA
KEY_GEOG	FORT MCMURRAY, ALBERTA
KEY_PARAM	TOXIC, ORGANICS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, SEDIMENT
KEY_MISC1	OIL SANDS, RIVER, BENTHOS, STUDIES, HYDROLOGY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Barton, D.R. and R.R. Wallace.
DATE	1980.
DUP_DATE	
TITLE	Ecological Studies of the Aquatic Invertebrates of the Alberta Oil Sands Environmental Research Program Study Area of Northeastern Alberta.
OTHER1	
PUBLISHER	Alberta Environment and Environment Canada, Edmonton, Alberta.
OTHER2	AOSERP Report 88, Project AF 2.0.1.

ANNOTATION Invertebrate fauna of the Athabasca River and its tributaries, the Muskeg and Steepbank rivers are described from baseline information gathered in 1976 and 1977. Twelve sites on the Muskeg and Steepbank rivers were sampled four to five times between July 1976 and July 1977. Samples were collected by kick sampling using a coarse meshed dip net. Sampling of the Athabasca River in 1977 illustrated that development of benthic communities is strongly influenced by substrate. A study of the effects of exposure to oil sands on the composition of benthic invertebrates was also conducted.

KEY_WATER	ATHABASCA, MUSKEG, STEEPBANK
KEY_GEOG	FORT MCMURRAY, ALBERTA
KEY_PARAM	
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	BASELINE, RIVER, BENTHOS, OIL SANDS, SURVEY, SAMPLING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Beak Associates.
DATE	1988
DUP_DATE	(Draft).
TITLE	1987 Athabasca River Water Quality Program, Phase One.
OTHER1	Prepared for Suncor Inc. Oil Sands Group.
PUBLISHER	Beak Associates Consulting Ltd., Edmonton, Alberta.
OTHER2	June 1988. Project No. 10-191-01-01. 42 pp. + Appendices.
ANNOTATION	In 1987, a study was carried out to collect baseline data on EPA priority pollutants, chronic toxicity to fish, water odour and fish taste within the Athabasca River and to determine whether or not environmental impacts of the Suncor operation could be detected in the river.
KEY_WATER	ATHABASCA
KEY_GEOG	ATHABASCA
KEY_PARAM	METALS, NON-METAL INORGANICS, ORGANICS
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	BASELINE, TOXIC, SUNCOR, OIL, IMPACT, FISH, STUDIES, SAMPLING, WATER QUALITY, EFFLUENT, MONITORING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Beak Associates.
DATE	1989
DUP_DATE	
TITLE	1982 Athabasca River Water Quality Assessment, Suncor Inc. Oil Sands Group, June, 1988.
OTHER1	Draft.
PUBLISHER	Beak Associates Consulting Ltd., Edmonton, Alberta.
OTHER2	February 2, 1989. Project No. 10-234-01-01. 58 pp. + Appendices.
ANNOTATION	In response to upset conditions at the Suncor oil sands plant, research was initiated to determine the impact of the upset on the Athabasca River. The research included an assessment of fish distribution and tainting, and benthic invertebrate monitoring using artificial substrates. Benthic sampling was done at seven sites on the Athabasca River in August and September 1982. Artificial samplers consisting of baskets of cobble-sized rocks were suspended in the river for approximately one month.
KEY_WATER	ATHABASCA, PEACE-ATHABASCA, BEAVER, MACKAY
KEY_GEOG	ATHABASCA
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN DEMAND, TOXIC
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	BENTHOS, SAMPLING, SUNCOR, EFFLUENT, OIL SANDS, ECOLOGY, SALMONID, FISH, WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Beak Associates.
DATE	1990
DUP_DATE	
TITLE	Winter Water Quality Survey on the Athabasca River, February 1990.
OTHER1	Prepared for Alberta Newsprint Company Ltd. and Millar Western Pulp Ltd., Whitecourt, Alberta.
PUBLISHER	Beak Associates Consulting Ltd., Calgary, Alberta.
OTHER2	April 1990. Project No. 9-013-01-01. 15 pp.
ANNOTATION	Water quality sampling was conducted at 11 locations from Windfall bridge to just upstream of Smith on the Athabasca River, plus tributary streams and effluents on February 21-23, 1990. Nutrient measurements included total phosphate, total Kjeldahl nitrogen, ammonia nitrogen and nitrite-nitrate nitrogen. Water quality parameters examined included physical characteristics, metals, non-metal inorganics, organics, dissolved oxygen, BOD, phenolics and resins.
KEY_WATER	ATHABASCA, MCLEOD, PEMBINA
KEY_GEOG	ALBERTA, WHITECOURT
KEY_PARAM	METALS, PHYSICAL PARAMETERS, OXYGEN, OXYGEN DEMAND, ORGANICS, NON-METAL INORGANICS
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	BACTERIA
KEY_MEDIA	WATER
KEY_MISC1	WATER QUALITY, SURVEY, RIVER, ANC, MILLAR WESTERN, PULP MILL, EFFLUENT, SAMPLING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Beak Associates.
DATE	1991
DUP_DATE	a.
TITLE	Benthic Invertebrate Monitoring Study on the Athabasca and McLeod Rivers Near Whitecourt, Alberta, 1990.
OTHER1	Prepared for Millar Western Pulp Ltd.
PUBLISHER	Beak Associates Consulting Ltd., Calgary, Alberta.
OTHER2	April 1991. Project No. 09-020-01-01. 63 pp. + Appendices.
ANNOTATION	Benthic invertebrate sampling (using a modified Neill-Hess cylinder) was conducted during May 14-17, and October 11-15, 1990 at 8 sites (5 replicates per site) on the McLeod and Athabasca Rivers in the vicinity of the ANC and Millar Western effluent and Town of Whitecourt sewage discharges.
KEY_WATER	ATHABASCA, MCLEOD
KEY_GEOG	WHITECOURT, ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN DEMAND, OXYGEN, ORGANICS, METALS, NON-METAL INORGANICS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	BIOTA, WATER
KEY_MISC1	RIVER, PULP MILL, BENTHOS, MONITORING, MILLAR WESTERN, SURVEY, EFFLUENT, SAMPLING, WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Beak Associates.
DATE	1991
DUP_DATE	b.
TITLE	Benthic Invertebrate Monitoring Study on the Athabasca River, Whitecourt, Alberta, 1990.
OTHER1	Prepared for Alberta Newsprint Company Ltd., Whitecourt, Alberta.
PUBLISHER	Beak Associates Consulting Ltd., Calgary, Alberta.
OTHER2	April 1991. Project No. 09-021-01-01. 62 pp. + Appendices.

ANNOTATION	Benthic invertebrate and water quality sampling was conducted on May 14-17 and October 11-15, 1990 to provide pre-operational and operational (start-up) data for the Athabasca River above and below the ANC CTMP mill which began operations in August 1990. Five replicate samples were collected at seven sites using a modified Neill-Hess cylinder sampler. Water quality analyses for nutrients (total phosphorus and total Kjeldahl nitrogen) was assessed by testing organics, metals and non-metal inorganics.

KEY_WATER	ATHABASCA, MCLEOD
KEY_GEOG	ALBERTA, WHITECOURT
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN DEMAND, OXYGEN, ORGANICS, METALS, NON-METAL INORGANICS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	SURVEY, BENTHOS, RIVER, ANC, WATER QUALITY, SAMPLING, MONITORING, EFFLUENT, PULP MILL
KEY_MISC2	
KEY_MISC3	

AUTHOR	Beak Associates.
DATE	1991
DUP_DATE	c.
TITLE	Winter Water Quality Survey on the Athabasca River, February 1991.
OTHER1	Prepared for Millar Western Pulp Ltd. and Alberta Newsprint Company, Whitecourt, Alberta.
PUBLISHER	Beak Associates Consulting Ltd., Calgary, Alberta.
OTHER2	June 1991. Project No. 09-055-01-01. 20 pp.

ANNOTATION In February 1991 a 2-day survey was conducted at 13 locations on the Athabasca River and its tributaries (near Whitecourt), to determine the water quality both upstream and downstream of effluent discharge points coming from Millar Western Pulp Ltd. and Alberta Newsprint Company.

Parameters were measured using "standard methods" of analyses. Parameters include dissolved oxygen, BOD, major ions, metals, nutrients, suspended solids, physical parameters, color, phenols, chelators, coliforms and resin acids.

KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA, WHITECOURT
KEY_PARAM	METAL, NON-METAL INORGANICS, OXYGEN, OXYGEN DEMAND, TOXIC, ORGANICS, PHYSICAL PARAMETERS, NUTRIENTS
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	BACTERIA
KEY_MEDIA	WATER
KEY_MISC1	RIVER, MILLAR WESTERN, ANC, WATER QUALITY, NUTRIENT, PULP MILL, MONITORING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Beak Consultants Limited.
DATE	1977
DUP_DATE	
TITLE	Biological and Water Quality Survey of the Athabasca River 1976.
OTHER1	Prepared for North Western Pulp and Power Ltd., Hinton, Alberta.
PUBLISHER	Beak Consultants Limited, Calgary, Alberta.
OTHER2	March 1977.
ANNOTATION	A biological and water quality survey of the Athabasca River was conducted on 96 km of river in the vicinity of Hinton during September and October 1976. The chemical analysis included physical characteristics, organics and BOD. Benthic invertebrates were sampled using six artificial substrate trays at ten locations. Trays remained in the river for one month. Biota were not analyzed for contaminants.
KEY_WATER	ATHABASCA
KEY_GEOG	HINTON, ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN, TOXIC, ORGANICS, OXYGEN DEMAND
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	BIOTA, WATER
KEY_MISC1	WATER QUALITY, SURVEY, BENTHOS, EFFLUENT, PULP MILL, STUDIES
KEY_MISC2	
KEY_MISC3	

AUTHOR	Beak Consultants Limited.
DATE	1978
DUP_DATE	
TITLE	Biological and Water Quality Survey of the Athabasca River 1977.
OTHER1	Prepared for North Western Pulp and Power Ltd., Hinton, Alberta.
PUBLISHER	Beak Consultants Limited, Calgary, Alberta.
OTHER2	January 1978.
ANNOTATION	Athabasca River water samples were collected on April 25 to May 20, 1977 from nine stations extending 4.8 km upstream of the St. Regis pulp mill effluent and 44 km downstream. The chemical analyses performed included physical parameters, organics and BOD. Benthic invertebrates were sampled using artificial substrate trays. Siltation of the samplers occurred in this survey. Minimal contaminant information.
KEY_WATER	ATHABASCA
KEY_GEOG	HINTON, ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN, TOXIC, ORGANICS, OXYGEN DEMAND
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	BIOTA, WATER
KEY_MISC1	WATER QUALITY, SURVEY, BENTHOS, EFFLUENT, PULP MILL, STUDIES
KEY_MISC2	
KEY_MISC3	

AUTHOR	Beaubien, V.
DATE	1983
DUP_DATE	a.
TITLE	Water Quality of the Athabasca River Basin. A Compilation of Non-NAQUADAT Water Quality Data.
OTHER1	
PUBLISHER	Alberta Environment, Planning Division.
OTHER2	September 1983; 36 pp.
ANNOTATION	"This report provides an index only of Athabasca River Basin water quality data not available in NAQUADAT File. It is a listing of data collection sites, periods of record, data source and collection purpose, but no actual water quality data" (cited from McGregor and Cary, 1991).
KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	
KEY_MISC1	DATABASE, RIVER, WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Beaubien, V.
DATE	1983
DUP_DATE	b.
TITLE	Water Resources Information for Coal Developments in the Athabasca River Headwaters.
OTHER1	
PUBLISHER	Alberta Environment, Planning Division.
OTHER2	
ANNOTATION	"Report summarizes and presents water resources information on existing and proposed coal developments in the Athabasca River headwaters. Focus is on the water management systems for the mines and the potential impacts on the surrounding watersheds. Information has been compiled for: type of mine, type of coal, production, location, project status, area of disturbance, schedule, work force, water supply watershed, changes in flow regime, changes in water quality, water management, fisheries, wildlife and recreation, monitoring programs, sources of information" (cited from McGregor and Cary, 1991).
KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	
KEY_MISC1	WATER RESOURCES, BASIN, MINING, WATER QUALITY, HYDROLOGY, FISH
KEY_MISC2	
KEY_MISC3	

AUTHOR	Boerger, H.
DATE	1983.
DUP_DATE	
TITLE	Distribution and Abundance of Macrobenthos in the Athabasca River near Fort McMurray.
OTHER1	
PUBLISHER	Research Management Division, Alberta Environment, Edmonton, Alberta.
OTHER2	Report OF-53.
ANNOTATION	Benthic macroinvertebrates were collected from gravel bars with a cylinder sampler at two-week intervals May 13 to August 18, 1982 at 16 sites along an 85 km stretch of the Athabasca River between Fort McMurray and the Ells River. The average densities of macroinvertebrates at locations downstream of the Suncor plant were 31% lower than upstream locations, but average densities were also influenced by the Fort McMurray sewage treatment plant and the Clearwater River. Contaminant levels in the invertebrates were not measured.
KEY_WATER	ATHABASCA
KEY_GEOG	FORT MCMURRAY, ALBERTA
KEY_PARAM	
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	BENTHOS, RIVER, SUNCOR, OIL, SURVEY, SAMPLING, SEWAGE TREATMENT
KEY_MISC2	
KEY_MISC3	

AUTHOR	Bramm, S.
DATE	1983.
DUP_DATE	
TITLE	A Bibliography of the Peace-Athabasca Delta.
OTHER1	For Alberta Environment Library.
PUBLISHER	Alberta Environment. Edmonton, Alberta.
OTHER2	March 1993.
ANNOTATION	This is a bibliography of the holdings of the Alberta Environment Library which refer to the watercourses and adjacent land areas of the Peace-Athabasca Delta, the watershed of Lake Athabasca (Alberta portions), and Wood Buffalo National Park. Included are books, reports and periodical articles referring to the following areas of interest: surface water and ground water, water resources management, water quality and pollution, aquatic flora and fauna, land use planning, inventory and impacts, and geology. There are 150 distinct entries, each indexed by author(s), title and geographic location(s).
KEY_WATER	PEACE-ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	
KEY_ANIMAL	FAUNA
KEY_PLANT	FLORA
KEY_MCROBE	
KEY_MEDIA	SEDIMENT, WATER, BIOTA
KEY_MISC1	BIBLIOGRAPHY, GENERAL REFERENCES, RIVER, STUDIES, WATER RESOURCES, WATER QUALITY, GEOLOGY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Brownlee, B. and W.M.J. Strachan.
DATE	1977
DUP_DATE	
TITLE	Distribution of some organic compounds in the receiving waters of a kraft pulp and paper mill
OTHER1	
PUBLISHER	J. Fish. Res. Board Can. 34:830-347
OTHER2	
ANNOTATION	"Water, seston, sediment, and macrophyte samples were collected from Nipigon Bay, Lake Superior, at distances up to 6.8 km from the effluent discharge of a kraft pulp and paper mill at Red Rock, Ontario. Fifteen compounds have been identified in mill effluent and six of these were found in samples from the Bay. Mill-related compounds were found most often in water and sediment samples, less often in seston samples, and in none of the macrophytes samples." (from Introduction)
KEY_WATER	LAKE SUPERIOR
KEY_GEOG	ONTARIO
KEY_PARAM	ORGANICS, CHLORINATED ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	MACROPHYTE
KEY_MCROBE	
KEY_MEDIA	WATER, SEDIMENT, BIOTA
KEY_MISC1	SAMPLING, PULP MILL, EFFLUENT, LAKE, WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR Brownlee, B., M.E. Fox, W.M.J. Strachan and S.R. Joshi.
DATE 1977.
DUP_DATE
TITLE Distribution of Dehydroabietic Acid in Sediments Adjacent to a Kraft Pulp and Paper Mill.
OTHER1
PUBLISHER J. Fish. Res. Board Can. 34:838-843.
OTHER2

ANNOTATION "Sediments adjacent to a kraft pulp and paper mill on western Nipigon Bay, Lake Superior, were examined for resin acids. Dehydroabietic acid was the predominant resin acid with surficial concentrations of less than 5-100 ug/g.

The areal distribution indicated the mill to be the primary source of this compound. Depth profiles of the acid and core dating by 210Pb methods enabled the calculation of a mean sediment accumulation rate of 0.11 cm x yr-1 and a half-life for the disappearance of dehydroabietic acid in the sediments of approximately 21 yr. A half-life of 0.12 yr was estimated for this compound in the water column. It appears, therefore, that the primary removal mechanism of dehydroabietic acid is degradation in the water column" (cited from document abstract).

KEY_WATER
KEY_GEOG CANADA
KEY_PARAM TOXIC, ORGANICS
KEY_ANIMAL
KEY_PLANT
KEY_MCROBE
KEY_MEDIA SEDIMENT, WATER
KEY_MISC1 GEOLOGY, PULP MILL
KEY_MISC2
KEY_MISC3

AUTHOR	Brownlee, B.G., G.A. MacInnis and L.R. Noton.
DATE	1992.
DUP_DATE	
TITLE	Chlorinated Anisoles and Veratroles in a Canadian River Receiving Bleached Kraft Pulp Mill Effluent: Identification, Distribution and Olfactory Evaluation.
OTHER1	
PUBLISHER	Rivers Research Branch, National Water Research Institute, Environment Canada and Environmental Quality Monitoring Branch, Alberta Environment.
OTHER2	NWRI Contribution No. 92-144.
ANNOTATION	"One chlorinated anisole and three chlorinated veratroles have been identified in extracts of Athabasca River water collected in the winter downstream from a bleached kraft pulp mill effluent (at Hinton). Their potential for causing off-flavours in the receiving waters was evaluated....Several of these compounds were found as far as 1100 km downstream from the pulp mill, consistent with field observations of odour in this river during the ice-covered winter period" (as cited in document).
KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	TOXIC, CHLORINATED ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	SEDIMENT, WATER, BIOTA
KEY_MISC1	CONTAMINANT, BIOACCUMULATION, ORGANOCHLORINE, PULP MILL, RIVER, SAMPLING, STUDIES, EFFLUENT
KEY_MISC2	
KEY_MISC3	

AUTHOR	Campbell, D., D. Dowhaniuk, J. Kostler, C. Ng, G. Scammell and M. Vukadinovic.
DATE	1981
DUP_DATE	
TITLE	1981 Annual Report, Industrial Effluent Monitoring.
OTHER1	
PUBLISHER	Water Quality Control Branch, Pollution Control Division, Alberta Environment.
OTHER2	
ANNOTATION	This program reviews: 1) monthly reports by the industries, identifying and following up problem areas, 2) random sampling of industrial effluents, 3) inspection of industrial wastewater treatment facilities, and 4) working with the industry to solve problems and achieve compliance. The report summarizes 1981 activities. It provides a summary of wastewater compliance for the industries licenced under the Clean Water Act. It gives annual volume of effluent discharges for the last four years. It covers individual licensee performance in 1981. And it includes other operations that are not included in the industrial summary (licensee performance in 1981).
KEY_WATER	ATHABASCA, PEACE, NORTH SASKATCHEWAN, RED DEER, WAPITI, SMOKY
KEY_GEOG	ALBERTA, GRANDE PRAIRIE, FORT MCMURRAY, HINTON
KEY_PARAM	EXTENSIVE
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	
KEY_MISC1	EFFLUENT, HINTON, INDUSTRY, RIVER, MONITORING, PROCTER & GAMBLE, OIL SANDS, SUNCOR, SYNCRUDE
KEY_MISC2	WATER QUALITY, PULP MILL, WATER USE, LICENCE, ANNUAL REPORT
KEY_MISC3	

AUTHOR	Canadian Bio Resources Consultants Ltd.
DATE	1979
DUP_DATE	
TITLE	Peace River Site C Hydroelectric Development - Environmental & Socio-economic Assessment - Water Quality and Use.
OTHER1	
PUBLISHER	B.C. Hydro.
OTHER2	
ANNOTATION	"Purpose of study was to project the effects of proposed Peace River Site C hydroelectric development on water quality, and on use of water; for water supply and waste water disposal purposes" (cited from McGregor and Cary, 1991).
KEY_WATER	PEACE
KEY_GEOG	
KEY_PARAM	
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	
KEY_MISC1	RIVER, WATER QUALITY, WATER USE
KEY_MISC2	
KEY_MISC3	

AUTHOR	Canadian Council of Resource and Energy Ministers (CCREM).
DATE	1987
DUP_DATE	
TITLE	Canadian Water Quality Guidelines.
OTHER1	
PUBLISHER	Task Force on Water Quality Guidelines, Canadian Council of Resource and Environment Ministers, Environment Canada, Ottawa. (updated to 1993)
OTHER2	

ANNOTATION

The Task Force on water quality guidelines for the Canadian Council of Resource and Environment Ministers, prepared water quality guidelines relevant to Canadian conditions.

In preparing this document, the Task Force reviewed the water quality guidelines for inland waters available from Canadian and other sources. These guidelines were reviewed for applicability in Canada and adapted to suit Canadian conditions where necessary. The information gaps identified during the development of the guidelines were noted and reported to Council as research priorities. The guidelines are updated as new information becomes available. Topical categories include: 1. raw water for drinking water supply; 2. recreational water quality and aesthetics; 3. freshwater aquatic life; 4. agricultural uses; and 5. industrial water supplies.

KEY_WATER	
KEY_GEOG	CANADA
KEY_PARAM	
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Charlton, S.E.D. and M. Hickman.
DATE	1984.
DUP_DATE	
TITLE	Seasonal Physical, Chemical and Algal Changes in Five Rivers Flowing Through the Oil Sands Region of Alberta, Canada.
OTHER1	In Int. Revue ges. Hydrobiol. 69(3): 297-332.
PUBLISHER	
OTHER2	

ANNOTATION	Epilithic algal communities and water quality were studied seasonally in 1978 and 1979 at specific sites in five tributary rivers flowing through the northeastern Alberta oil sands region to the Athabasca River. The tributaries are the Muskeg, Steepbank, Hangingstone, Ells and MacKay rivers. Algae were collected quantitatively, identified to species and enumerated.

KEY_WATER	MUSKEG, STEEPBANK, MACKAY, ATHABASCA
KEY_GEOG	FORT MCMURRAY, ATHABASCA, ALBERTA
KEY_PARAM	NON-METAL INORGANICS, PHYSICAL PARAMETERS, NUTRIENTS
KEY_ANIMAL	
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	OIL SANDS, RIVER, WATER QUALITY, NUTRIENT
KEY_MISC2	
KEY_MISC3	

AUTHOR	Charlton, S.E.D., M. Hickman and C.G. Jenkerson.
DATE	1981.
DUP_DATE	
TITLE	Longitudinal Physico-chemical and Algal Surveys of Rivers Flowing Through the Oil Sands Region of Northeastern Alberta, Canada.
OTHER1	In Nova Hedwigia 35: 465-522. Edited by J. Cramer.
PUBLISHER	
OTHER2	

ANNOTATION	Longitudinal synoptic surveys of five rivers flowing through the oil sands region of Alberta included measurement of various physico-chemical parameters, algal species composition and standing crops. Synoptic surveys were conducted in June on the Ells River, July on the Muskeg River, and September for the Hangingstone, MacKay and Steepbank rivers. Algae were collected quantitatively, identified to species and enumerated.

KEY_WATER	MUSKEG, STEEPBANK, MACKAY, ATHABASCA
KEY_GEOG	FORT MCMURRAY, ATHABASCA, ALBERTA
KEY_PARAM	NON-METAL INORGANICS, PHYSICAL PARAMETERS, NUTRIENTS
KEY_ANIMAL	
KEY_PLANT	ALGAE, CHLOROPHYLL
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	OIL SANDS, RIVER, SURVEY, NUTRIENT, BENTHOS
KEY_MISC2	
KEY_MISC3	

AUTHOR	Clayton, D.
DATE	1972
DUP_DATE	
TITLE	Water Quality Summary, Athabasca River, 1966-1971.
OTHER1	
PUBLISHER	Standards and Approvals Division, Alberta Environment.
OTHER2	11 pp + Appendices.

ANNOTATION This document summarizes pollution surveys between 1966 and 1971 that were conducted on the Athabasca River. Recommendations for new water quality standards are provided. Information is provided regarding biochemical oxygen demand (BOD), dissolved oxygen, odour, and levels of phenols, phosphate, nitrogen, tannins and lignins, heavy metals and bacteria.

KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	EXTENSIVE
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	RIVER, WATER QUALITY, POLLUTION, MONITORING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Cook, P.M., D.W. Kuehl, M.K. Walker and R.E. Peterson.
DATE	1991
DUP_DATE	
TITLE	Bioaccumulation and Toxicity of TCDD and Related Compounds in Aquatic Ecosystems.
OTHER1	
PUBLISHER	In: Banbury Report 35: Biological Basis for Risk Assessment of Dioxins and Related Compounds, Cold Spring Harbor Laboratory Press.
OTHER2	
ANNOTATION	This study looked at how the exposure of aquatic organisms to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and related chemicals is linked to toxic and other biological effects in fish, wildlife or humans. Key elements of this linkage are (1) the bioconcentration factor (BCF) of TCDD and (2) the identification of the most sensitive toxic effects associated with TCDD exposure. Mean steady-state BCFs were determined in the laboratory for carp and fathead minnows exposed to TCDD.
KEY_WATER	
KEY_GEOG	
KEY_PARAM	CHLORINATED ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	FISH, BIOACCUMULATION, HUMAN HEALTH, ORGANOCHLORINE, REPRODUCTION, SALMONID, STUDIES, DIOXINS
KEY_MISC2	
KEY_MISC3	

AUTHOR Corkum, L.
DATE 1985.
DUP_DATE
TITLE Water Quality of the Athabasca Oil Sands Area: A Regional Study.
OTHER1
PUBLISHER Water Quality Control Branch, Alberta Environment.
OTHER2 AOSERP Report L-85. 273 pp.

ANNOTATION "The objective of this report is to summarize water quality constituents in the AOSERP study area and to examine relationships between these constituents and changes in land formation, hydrology, and development.

Summaries of routine parameters, nutrients, and metals are presented for sampling sites along the Athabasca River to detect longitudinal and seasonal changes in water quality and to determine the effects of point source effluents on the river. A principal component analysis (PCA) was used for the simultaneous examination of selected water quality parameters on the Athabasca River. Sites exhibiting similar water quality characteristics were delineated on schematic maps of the river.

Baseline data and relationships among parameters also are presented for east, west and south drainages entering the Athabasca River between Fort McMurray and Embarras Airport, as well as the Athabasca Delta drainage. An overall analysis of the four regions was conducted using PCA to delineate those sites with similar water quality characteristics. Site groupings often reflected the geological type of the region" (as cited in document).

KEY_WATER ATHABASCA, CLEARWATER, MUSKEG
KEY_GEOG FORT MCMURRAY, EMBARRAS, ALBERTA
KEY_PARAM PHYSICAL PARAMETERS, ORGANICS, NON-METAL INORGANICS, METALS, NUTRIENTS
KEY_ANIMAL INVERTEBRATE
KEY_PLANT
KEY_MCROBE BACTERIA
KEY_MEDIA WATER
KEY_MISC1 BASELINE, EFFLUENT, RIVER, NUTRIENT, WATER QUALITY, HYDROLOGY, GEOLOGY, SAMPLING, STUDIES, OIL
KEY_MISC2
KEY_MISC3

AUTHOR	Crowther, R.A.
DATE	1979.
DUP_DATE	
TITLE	Ecological Investigations of Hartley Creek, Alberta.
OTHER1	A thesis submitted to the Faculty of Graduate Studies in partial fulfilment of the requirements for the degree of Doctor of Philosophy.
PUBLISHER	Department of Biology, University of Calgary.
OTHER2	November 7, 1979.

ANNOTATION	This thesis examined the ecology of adult and immature benthic invertebrates inhabiting Hartley Creek, a tributary to the Athabasca River, monthly during the open water season from May 1976 to November 1977. Algae, bacteria and physical parameters were also measured. Data was analyzed by reciprocal averaging ordination and discriminant analysis.

KEY_WATER	HARTLEY, MUSKEG, ATHABASCA
KEY_GEOG	FORT MCMURRAY, ATHABASCA, ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE, CHLOROPHYLL
KEY_MCROBE	BACTERIA
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	OIL SANDS, RIVER, BENTHOS, STUDIES, REPRODUCTION, ECOLOGY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Crowther, R.A. and B.J. Lade.
DATE	1981
DUP_DATE	
TITLE	An Assessment of Benthic Secondary Production in the Muskeg River of Northeastern Alberta.
OTHER1	Prepared for the Alberta Oil Sands Environmental Research Program.
PUBLISHER	IEC International Environmental Consultants Ltd.
OTHER2	AOSERP Report 116. 106 pp.
ANNOTATION	This study of benthic invertebrates in the Muskeg River, a tributary of the Athabasca River in the oil sands area, assessed changes in the level of secondary production and related these to changes in substrate. Ten replicate benthic samples were collected at three sites with a modified Neill cylinder.
KEY_WATER	MUSKEG, ATHABASCA
KEY_GEOG	FORT MCMURRAY, ATHABASCA, ALBERTA
KEY_PARAM	
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	SEDIMENT
KEY_MISC1	BENTHOS, RIVER, SURVEY, STUDIES, ECOSYSTEM
KEY_MISC2	
KEY_MISC3	

AUTHOR	D.A. Westworth & Associates. Ltd.
DATE	1992
DUP_DATE	
TITLE	An Overview of Potential Forest Harvesting Impacts on Fish and Fish Habitat in the Northern Boreal Forests of Canada's Prairie Provinces.
OTHER1	Prepared for Department of Fisheries and Oceans.
PUBLISHER	Department of Fisheries and Oceans, Environment Canada.
OTHER2	

ANNOTATION "The principle objectives of this 1991 study were to 1) identify potential impacts of forestry operations on fish and fish habitat, 2) evaluate regulatory and administrative mechanisms that are in place to protect fish and fish habitat, and 3) to identify inventory and research requirements. Two existing forestry projects in Manitoba and Alberta were used as case studies. An effort was made to demonstrate the feasibility of using existing data to evaluate the environmental risks associated with timber harvesting at the watershed scale." (cited from document).

A very general discussion is given on increased oxygen demand and eutrophication, in lakes and rivers, as a result of timber harvesting. The Alberta case study describes and demonstrates the feasability of the Geographic Information System (GIS) technology to evaluate environmental risks associated with timber harvesting at the wastershed scale... Information was compiled from eleven watersheds in northeastern Alberta, including the Athabasca River.

KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	RIVER, BASIN, FISH, FOREST HARVESTING, ECOSYSTEM
KEY_MISC2	
KEY_MISC3	

AUTHOR	Dutka, B.J., K.K. Kwan, S.S. Rao, A. Jurkovic, R. McInnis, G.A. McInnis, B. Brownlee, and D. Liu.
DATE	1990.
DUP_DATE	
TITLE	Ecotoxicological Study of Waters, Sediment and Suspended Sediments in the Athabasca, Peace and Slave Rivers.
OTHER1	June 1990.
PUBLISHER	
OTHER2	

ANNOTATION "This report describes an exploratory ecotoxicological study of the waters, sediments, and suspended sediments in the Athabasca, Peace and Slave Rivers. During the study a variety of concentration and extraction procedures were evaluated in order to enhance the sensitivity of the various bioassays used to screen for toxicant/genotoxicant activity. As part of this project an intensive study was carried out on the bacterial and nutrient content associated with the various sized suspended particulates fractions. Based on ecotoxicological data collected from sediments, suspended sediments and water samples, there appears to be an indication of an effect downstream of the Suncor and Syncrude oil sands plants, even though samples from above the plants indicated the presence of sufficient contaminants to trigger responses in various toxicant screening tests" (cited from document abstracts).

KEY_WATER	ATHABASCA, PEACE, SLAVE
KEY_GEOG	ALBERTA, NORTHWEST TERRITORIES
KEY_PARAM	TOXIC
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, SEDIMENT
KEY_MISC1	RIVER, WATER QUALITY, CONTAMINANTS, OIL SANDS
KEY_MISC2	
KEY_MISC3	

AUTHOR	Environment Canada.
DATE	1978
DUP_DATE	
TITLE	Bioaccumulation of Toxic Compounds in Pulpmill Effluents by Aquatic Organisms in Receiving Waters.
OTHER1	Prepared by New Brunswick Research & Productivity Council. Progress Report to April 30, 1978.
PUBLISHER	Environmental Protection Service, Environment Canada.
OTHER2	Pulp and Paper Pollution Abatement: A Research Program Sponsored by the Department of the Environment in Cooperation with the Canadian Pulp and Paper Industry.
ANNOTATION	"After development of analytical techniques, sediments and tissues of estuarine plankton, fish and benthos from five stations in Saint John Harbour were examined for the presence of bioaccumulated compounds from pulp mill effluents. Chlorinated compounds and resin acids were identified by comparison with fingerprints of effluents from a groundwood and bleached kraft mill in the study area. Chlorinated compounds detected were dichlorophenol, trichlorophenol, trichloroguaiacol and tetrachloroguaiacol. Dehydroabietic acid was detected in some samples but further analysis of tissue was prevented by interference from the presence of other compounds accumulated in the samples" (cited from document abstract).
KEY_WATER	
KEY_GEOG	CANADA
KEY_PARAM	ORGANICS, CHLORINATED ORGANICS, PHYSICAL PARAMETERS
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA, EFFLUENT
KEY_MISC1	BIOACCUMULATION, FISH, FATE, PULP MILL, EFFLUENT, SAMPLING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Environment Canada.
DATE	1985
DUP_DATE	
TITLE	Polychlorinated Dibenzo-p-Dioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs): Sources and Releases
OTHER1	
PUBLISHER	Environmental Protection Service, Environment Canada
OTHER2	
ANNOTATION	"This report provides a preliminary overview of sources and releases of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) in the Canadian environment. Available data on PCDD and PCDF concentrations in air emissions, liquid effluents, solid wastes and chemicals in commerce have been summarized...Forest fires may represent the largest combustion source of PCDD releases to the environment." (from abstract)
KEY_WATER	
KEY_GEOG	CANADA
KEY_PARAM	CHLORINATED ORGANICS
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	AIR, EFFLUENT
KEY_MISC1	CONTAMINANT, DIOXINS, FURANS
KEY_MISC2	
KEY_MISC3	

AUTHOR	Environment Canada.
DATE	1991
DUP_DATE	
TITLE	Update on Water Quality Monitoring in Wood Buffalo National Park.
OTHER1	October, 1991.
PUBLISHER	Environment Canada.
OTHER2	
ANNOTATION	This report presents data available from August 1989 to August 1991 to provide a record of ongoing Park water quality monitoring. Analyses include nutrients, metals, major ions and general parameters for the Athabasca River at 27 baseline, the Peace River at Peace Point, and the Peace River at Garden River. Additional analytical results for fish and sediments are included as well. The report does not interpret the data.
KEY_WATER	ATHABASCA, PEACE, SLAVE
KEY_GEOG	NORTHWEST TERRITORIES, ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS, METALS, ORGANICS, NON-METAL INORGANICS, OXYGEN, NUTRIENTS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, SEDIMENT, FISH
KEY_MISC1	WATER QUALITY, NAQUADAT, SAMPLING, BASELINE, FISH, STUDIES, MONITORING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Environment Canada.
DATE	1992.
DUP_DATE	
TITLE	Technical Guidance Document For Aquatic Environmental Effects Monitoring.
OTHER1	
PUBLISHER	Department of Fisheries and Oceans, Environment Canada.
OTHER2	156 pp.
ANNOTATION	This document provides "guidance on how to perform the tasks needed to fulfill the requirements for the environmental effects monitoring (EEM) program under the Fisheries Act" (cited from document). General topics discussed include: 1) description of a study area, 2) sampling design, 3) general quality assurance/quality control for conducting EEM, 4) statistical sampling design, 5) sample collection for physical, chemical, bacteriological and toxicological studies, 6) physical, chemical, bacteriological analyses, 7) toxicity tests and fish tainting and behaviour evaluation, 8) adult fish survey, and 9) benthic community assessment.
KEY_WATER	
KEY_GEOG	
KEY_PARAM	TOXIC, NON-METAL INORGANICS, ORGANICS, OXYGEN, OXYGEN DEMAND, PHYSICAL PARAMETERS
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	ALGAE, CHLOROPHYLL
KEY_MCROBE	BACTERIA
KEY_MEDIA	WATER
KEY_MISC1	EFFLUENT, FISH, BENTHOS, SAMPLING, RIVER, WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Environmental Management Associates (EMA).
DATE	1989.
DUP_DATE	
TITLE	Wapiti-Smoky River Synoptic Water Quality Survey.
OTHER1	Prepared for Water Quality Control Branch, Alberta Environment, Edmonton, Alberta.
PUBLISHER	Environmental Management Associates, Calgary, Alberta.
OTHER2	March 1989.
ANNOTATION	This report contains the results of a March 1-9, 1989 synoptic water quality survey at sixteen sites on the Wapiti-Smoky River system during the critical low-flow, ice-cover period. Samples were analyzed for general water quality and effluent parameters, metals, major ions, nutrients, conventional organics and bacteria.
KEY_WATER	WAPITI, SMOKY, PEACE
KEY_GEOG	ALBERTA, GRANDE PRAIRIE, PEACE RIVER
KEY_PARAM	OXYGEN DEMAND, OXYGEN, PHYSICAL PARAMETERS, METALS, ORGANICS, NON-METAL INORGANICS, NUTRIENTS
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	BACTERIA
KEY_MEDIA	WATER
KEY_MISC1	SEWAGE TREATMENT, PROCTER & GAMBLE, PULP MILL, EFFLUENT, NAQUADAT, WATER QUALITY, MODEL, RIVER
KEY_MISC2	SAMPLING
KEY_MISC3	

AUTHOR	EVS Consultants Ltd.
DATE	1984.
DUP_DATE	
TITLE	Suncor Tailings Ponds Water Quality and Reclamation, 1984.
OTHER1	Presentation to Suncor, Inc., November 29, 1984.
PUBLISHER	EVS Consultants.
OTHER2	11th Annual Aquatic Toxicity Workshop. Introductory comments by John Sprague.
ANNOTATION	This report contains the material on the overheads which supported a presentation to Suncor, Inc. Contains summary tables and graphs of limnological (chemistry, biology, toxicology) studies on tailings ponds. Not directly related to Athabasca River.
KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	METAL, NON-METAL INORGANICS, PHYSICAL PARAMETERS, OXYGEN, OXYGEN DEMAND, ORGANICS, TOXIC, NUTRIENTS
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	BACTERIA
KEY_MEDIA	WATER, SEDIMENT
KEY_MISC1	ECOLOGY, FISH, STUDIES, MONITORING, SAMPLING, SUNCOR, OIL, WATER QUALITY, SURVEY, HYDROLOGY
KEY_MISC2	
KEY_MISC3	

AUTHOR	EVS Consultants Ltd.
DATE	1986.
DUP_DATE	
TITLE	Biological Effects Study of Dredged Material Discharge to the Athabasca River near Fort McMurray, Alberta.
OTHER1	Prepared for Environmental Affairs, Suncor, Inc., Oil Sands Division, Fort McMurray, Alberta.
PUBLISHER	EVS Consultants Ltd.
OTHER2	
ANNOTATION	Natural and artificial substrates were used to collect benthic invertebrates at seven sites within the Athabasca River located upstream and downstream of the summer 1986 dredging of the raw water pond at the Suncor oil sands operation. Dredging had no appreciable effect.
KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	FUNGI, BACTERIA, MICROBE
KEY_MEDIA	WATER, SEDIMENT
KEY_MISC1	SUNCOR, BENTHOS, OIL, EFFLUENT, IMPACT, RIVER, SURVEY
KEY_MISC2	
KEY_MISC3	

AUTHOR	EVS Consultants Ltd.
DATE	1990.
DUP_DATE	
TITLE	Volume I Baseline Environmental Studies of the Lesser Slave River.
OTHER1	Prepared for Slave Lake Pulp Corporation, Edmonton.
PUBLISHER	EVS Consultants, North Vancouver, B.C.
OTHER2	August, 1990. EVS Project No. 3/405-01.
ANNOTATION	Pre-operational baseline studies of the Lesser Slave River reported in this volume include the results of field work in the spring and fall of 1989 and the winter of 1990. The surveys included a habitat survey, water chemistry for a wide range of parameters including nutrients, organics, metals, dissolved oxygen modelling, bacteriological studies, periphyton, benthos and fisheries. Epilithic periphyton was sampled by artificial substrates (ceramic tiles) and analyzed for chlorophyll a. Benthic invertebrates were sampled (three replicates per sample) in May and October using a Ponar grab for silty areas and a Hess sampler for riffle areas.
KEY_WATER	LESSER SLAVE, ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	METAL, NON-METAL INORGANICS, ORGANICS, OXYGEN, OXYGEN DEMAND, PHYSICAL PARAMETERS, TOXIC, NUTRIENTS
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	ALGAE, CHLOROPHYLL
KEY_MCROBE	BACTERIA
KEY_MEDIA	WATER
KEY_MISC1	PULP MILL, BASELINE, RIVER, FISH, HYDROLOGY, EIA, NUTRIENT, BENTHOS, SAMPLING, SURVEY
KEY_MISC2	WATER QUALITY
KEY_MISC3	

AUTHOR	EVS Consultants Ltd.
DATE	1991.
DUP_DATE	
TITLE	Volume II Baseline Environmental Studies of the Lesser Slave River.
OTHER1	Prepared for Slave Lake Pulp Corporation, Edmonton.
PUBLISHER	EVS Consultants Ltd., North Vancouver, B.C.
OTHER2	May, 1991. EVS Project No. 3/405-03.
ANNOTATION	Pre-operational baseline studies of the Lesser Slave River reported in this volume include the results of field work in the spring and fall of 1990 and a comparison with the 1989 pre-operational data. The surveys included water chemistry for a wide range of parameters including nutrients, dissolved oxygen modelling, dioxins and furans, phenolics, resin acids and metals, bacteriological studies, periphyton, benthos and fisheries. Epilithic periphyton was sampled by scraping natural rock substrates and analyzed for chlorophyll a. Benthic invertebrates were sampled (3 replicates per sample) in May and October.
KEY_WATER	LESSER SLAVE, ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	METAL, TOXIC, ORGANICS, OXYGEN, PHYSICAL PARAMETERS, OXYGEN DEMAND, NON-METAL INORGANICS, NUTRIENTS
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	ALGAE, CHLOROPHYLL
KEY_MCROBE	BACTERIA
KEY_MEDIA	WATER, BIOTA, SEDIMENT
KEY_MISC1	PULP MILL, BASELINE, RIVER, FISH, EIA, NUTRIENT, BENTHOS, ORGANOCHLORINE, SURVEY, WATER QUALITY
KEY_MISC2	SLAVE LAKE, REPRODUCTION
KEY_MISC3	

AUTHOR	EVS Consultants Ltd.
DATE	1992
DUP_DATE	a.
TITLE	Review and Analysis of ANC River Monitoring Studies on the Athabasca River. Final Report.
OTHER1	Prepared for Alberta Newsprint Company, Whitecourt, Alberta.
PUBLISHER	EVS Consultants, North Vancouver, B.C.
OTHER2	EVS Project No. 3/561-01.2. July 1992.

ANNOTATION The report is divided into two tasks:

1) Task I - Review of ANC River Monitoring Studies on the Athabasca River. "This report provides a brief review and critique of three Beak/Sentar reports on benthic monitoring studies conducted on the Athabasca River in the vicinity of the ANC paper mill (1990, 1991, 1992)" (cited from document). Data are presented for chemical analyses, dissolved oxygen, benthic communities, EEM protocols and recommendations.

KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA, WHITECOURT
KEY_PARAM	OXYGEN, OXYGEN DEMAND
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	BENTHOS, RIVER, ANC, WATER QUALITY, INVENTORY, SURVEY, NUTRIENT, PULP MILL, ANC
KEY_MISC2	
KEY_MISC3	

AUTHOR	EVS Consultants Ltd.
DATE	1992
DUP_DATE	b.
TITLE	Volume III - 1991, 1991 Operational Monitoring of the Lesser Slave River.
OTHER1	Prepared for Slave Lake Pulp Corporation, Edmonton.
PUBLISHER	EVS Consultants Ltd., North Vancouver, B.C.
OTHER2	April 1992.
ANNOTATION	Operational monitoring of the Lesser Slave River reported in this volume includes the results of field work from May to September, 1991 and a comparison with the two years of pre-operational data. The surveys included sediment chemistry, water chemistry for a wide range of parameters including nutrients, diurnal dissolved oxygen, organics and metals in water, sediments and fish tissue, bacteriological studies, periphyton, benthos and fisheries. Epilithic periphyton was sampled by scraping natural rock substrates and analyzed for chlorophyll a. Benthic invertebrates were sampled (three replicates per sample) in May and October.
KEY_WATER	LESSER SLAVE, ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	OXYGEN DEMAND, METAL, TOXIC, ORGANICS, OXYGEN, PHYSICAL PARAMETERS, NON-METAL INORGANICS, NUTRIENTS
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	ALGAE, CHLOROPHYLL
KEY_MCROBE	BACTERIA
KEY_MEDIA	WATER
KEY_MISC1	PULP MILL, MONITORING, RIVER, WATER QUALITY, BENTHOS, ORGANOCHLORINE, NUTRIENT, FISH, SURVEY, EIA
KEY_MISC2	SLAVE LAKE, REPRODUCTION, BASELINE
KEY_MISC3	

AUTHOR	Goudey, J.S. and B.R. Taylor.
DATE	1992
DUP_DATE	
TITLE	Toxicity of Aspen Wood Leachate to Aquatic Life. Part I: Laboratory Studies. Final Report (Executive Summary only).
OTHER1	Prepared for Environmental Protection Branch, Northern Interior Region, B.C. Environment, Ministry of Environment, Lands and Parks.
PUBLISHER	HydroQual Laboratories Ltd., Calgary, Alberta.
OTHER2	September 1992. iv.

ANNOTATION This report briefly documents: (1) the rate and quantity of leaching loss from aspen wood, (2) the strength and persistence of aspen leachate to aquatic life, (3) the chemical nature of the leachate, and (4) the main classes of toxic constituents. Both fresh, non-aerated and aerated leachate were tested and compared. The main parameters observed were pH, conductivity, dissolved oxygen, biochemical oxygen demand, organic carbon, and phenols. The experiments conducted included tests of toxicity to rainbow trout and Daphnia, algal growth tests and a Microtox bacterial luminescence assay. Results determine that uncontrolled leachate is harmful to aquatic life "through direct toxicity (pH, phenols) and through deoxygenation of the water (BOD)." (cited from document). Analytical methods are not provided.

KEY_WATER	
KEY_GEOG	
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN, OXYGEN DEMAND, ORGANICS, TOXIC
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	BACTERIA
KEY_MEDIA	BIOTA
KEY_MISC1	FISH, BENTHOS, EXPERIMENT, FOREST HARVESTING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Gregoire, P.E. and A.M. Anderson.
DATE	1987
DUP_DATE	
TITLE	Athabasca River Zoobenthic Survey in the Vicinity of Athabasca, Fall 1985.
OTHER1	Environmental Assessment Division Internal Report.
PUBLISHER	Alberta Environment, Pollution Control Division, Edmonton. 18 pp.
OTHER2	
ANNOTATION	This study uses the benthic invertebrate community in the Athabasca River as an indicator of the impact on water quality from the sewage treatment plant at the Town of Athabasca. A survey was conducted on the Athabasca River in the fall of 1985. The invertebrate community was measured using total numbers of invertebrates, population of individual taxa, percent composition of major taxa and multivariate analysis.
KEY_WATER	ATHABASCA
KEY_GEOG	ATHABASCA, ALBERTA
KEY_PARAM	
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	BIOTA
KEY_MISC1	SEWAGE TREATMENT, RIVER, BENTHOS, STUDIES
KEY_MISC2	
KEY_MISC3	

AUTHOR	Hamilton, H.R., M.V. Thompson and L. Corkum.
DATE	1985.
DUP_DATE	
TITLE	Water Quality Overview of the Athabasca River Basin.
OTHER1	Prepared for Planning Division, Alberta Environment.
PUBLISHER	Nanuk Engineering Ltd.
OTHER2	117 pp. + Appendices.

ANNOTATION This report is an overview of water quality patterns for the Athabasca River and its tributaries. The information is taken from historical water quality records collected since 1970 and sampling surveys from 1984 and early 1985. The surveys were of mainstream and tributary sites, as well as effluents from municipal and pulp mill sources on the river. The parameters examined include organics, inorganics, metals, toxic compounds, oxygen demands and nutrients (nitrogen and phosphorus). The forms of nitrogen studied are nitrite-nitrate, ammonia and total nitrogen concentrations (mg/L). Concentrations of particulate and dissolved forms of phosphorus are presented as well. Biological data collected include chlorophyll a, total and fecal coliforms, algae and macrophytes. NAQUADAT codes are provided.

KEY_WATER	ATHABASCA
KEY_GEOG	HINTON, WHITECOURT, ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS, ORGANICS, NON-METAL INORGANICS, TOXIC, OXYGEN DEMAND, OXYGEN, METALS
KEY_ANIMAL	
KEY_PLANT	ALGAE, CHLOROPHYLL, MACROPHYTE
KEY_MCROBE	BACTERIA
KEY_MEDIA	EFFLUENT, WATER
KEY_MISC1	PULP MILL, SEWAGE TREATMENT, EFFLUENT, WATER QUALITY, SURVEY, BASIN, NAQUADAT
KEY_MISC2	
KEY_MISC3	

AUTHOR	Hamilton, H.R., R. Wallace, D. Westlake, J. Foght, B.R. Taylor and S. Hrudey.
DATE	1987.
DUP_DATE	
TITLE	Aquatic Fate of Fish Tainting Compounds in the Athabasca River.
OTHER1	Prepared for Research Management Division, Alberta Environment.
PUBLISHER	Hydroqual Consultants Inc., Dominion Ecological Ltd., and University of Alberta.
OTHER2	RMD Report L-96. 127 pp.
ANNOTATION	"This report investigates the relationship between certain hydrocarbons that are present naturally, or could be introduced due to surface oil sands mining and upgrading activities, and their potential bioaccumulation and tainting of the commercial fishery in the Athabasca River. This includes defining the contaminants of concern, reviewing their bioavailability and bioconcentration properties and consideration of their persistence in the aquatic environment of the Athabasca River. A water management approach for setting ambient surface water objectives and effluent standards for fish tainting compounds is discussed within the context of basin-wide water resource planning" (cited from document).
KEY_WATER	ATHABASCA
KEY_GEOG	FORT MCMURRAY, ALBERTA
KEY_PARAM	ORGANICS, PHYSICAL PARAMETERS
KEY_ANIMAL	INVERTEBRATE, VERTEBRATE
KEY_PLANT	
KEY_MCROBE	BACTERIA, MICROBE
KEY_MEDIA	WATER
KEY_MISC1	RIVER, FATE, FISH, CONTAMINANT, EFFLUENT, OIL SANDS, BIOACCUMULATION, MODEL, GEOLOGY, HYDROLOGY, SUN
KEY_MISC2	
KEY_MISC3	

AUTHOR	Hartland-Rowe, R.C.B., R. W Davies, M. McElhone, and R. Crowther.
DATE	1979
DUP_DATE	
TITLE	The Ecology of Macrobenthic Invertebrate Communities in Hartley Creek, Northeastern Alberta.
OTHER1	Prepared for the Alberta Oil Sands Environmental Research Program (AOSERP).
PUBLISHER	Department of Biology, University of Calgary.
OTHER2	AOSERP Report 49. ws 1.3.3. March 1979. 144 pp.

ANNOTATION

Hartley Creek is a tributary of the Muskeg River in the Athabasca Oil Sands area of northeastern Alberta. Invertebrate samples were collected during the 1976 and 1977 seasons, at six sites. Over 160 species of macroinvertebrates were collected. The goal of this project was to "assess invertebrate production and the factors that affect it in a small watershed in the oil sands area. Objectives were grouped within two broad areas, life cycle studies and community studies.... Ultimately the baseline information accumulated by this project was to be related to effects of oil sands developments." (as cited in document)

KEY_WATER	HARTLEY
KEY_GEOG	ALBERTA, ATHABASCA
KEY_PARAM	PHYSICAL PARAMETERS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	
KEY_MISC1	BASELINE, BENTHOS, OIL SANDS, RIVER, INVENTORY
KEY_MISC2	
KEY_MISC3	

AUTHOR	HBT AGRA Limited.
DATE	1992.
DUP_DATE	
TITLE	Environmental Monitoring Studies in the Vicinity of the Peace River Pulp Division Mill at Peace River, Alberta, May 1992.
OTHER1	Prepared for Daishowa-Marubeni International Ltd.
PUBLISHER	HBT AGRA Limited (formerly Monenco Consultants Ltd.).
OTHER2	November 30, 1992. CE 9001-6.
ANNOTATION	A water quality and benthic invertebrate survey was conducted at 15 sites (5 replicates per site) on the Peace and Smoky rivers upstream and downstream of the Peace River Pulp Division mill during May 21-22, 1992. A Hess cylinder sampler was used. Water quality analysis included nutrients, physical parameters, non-metal inorganics and metals.
KEY_WATER	PEACE, SMOKY
KEY_GEOG	ALBERTA, PEACE RIVER
KEY_PARAM	OXYGEN, PHYSICAL PARAMETERS, OXYGEN DEMAND, NON-METAL INORGANICS, METALS, NUTRIENTS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	WATER, SEDIMENT
KEY_MISC1	BENTHOS, WATER QUALITY, SAMPLING, DAISHOWA, PULP MILL, MONITORING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Hickman, M., S.E.D. Charlton and C.G. Jenkerson.
DATE	1982.
DUP_DATE	
TITLE	A Comparative Study of Benthic Algal Primary Productivity in the AOSERP Study Area.
OTHER1	Prepared for Alberta Oil Sands Environmental Research Program.
PUBLISHER	Department of Botany, University of Alberta and Department of Plant Sciences, University of Western Ontario.
OTHER2	AOSERP Report 128. 139 pp.
ANNOTATION	Studies concentrating upon the epilithic algal community were conducted in five tributary rivers to the Athabasca River: the Muskeg, Steepbank, Hangingstone, MacKay and Ells rivers. Samples were collected at one site in each river in 1978 and 1979. Epilithic algae were collected by scraping a defined area of natural rock. Species were identified and enumerated, chlorophyll a was measured, and primary productivity was measured using the carbon-14 technique. Water chemistry was analysed.
KEY_WATER	MUSKEG, STEEPBANK, MACKAY, ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE, CHLOROPHYLL
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	BENTHOS, RIVER, OIL SANDS, NUTRIENT, SAMPLING, WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Holmberg, R.
DATE	1992.
DUP_DATE	
TITLE	Pulp Mills and the Environment: An Annotated Bibliography of Northern Alberta.
OTHER1	May 1992.
PUBLISHER	Athabasca University, Athabasca; Canadian Circumpolar Institute, University of Alberta, Edmonton; Environmental Research and Study Cenre, University of Alberta, Edmonton.
OTHER2	
ANNOTATION	"An annotated list of books, technical reports and periodical articles related to the development and operation of pulp and paper mills in northern Alberta" (cited from document). This is a very general annotated bibliography.
KEY_WATER	ATHABASCA, CLEARWATER, PEACE, PEACE-ATHABASCA, MACKAY, HARTLEY, MUSKEG, STEEPBANK, BEAVER, WAPITI
KEY_GEOG	ALBERTA
KEY_PARAM	TOXIC, ORGANICS, CHLORINATED ORGANICS
KEY_ANIMAL	FAUNA, INVERTEBRATE, VERTEBRATE
KEY_PLANT	FLORA, ALGAE
KEY_MCROBE	
KEY_MEDIA	
KEY_MISC1	RIVER, PULP MILL, EIA, ALBERTA-PACIFIC, DAISHOWA, MILLAR WESTERN, FISH, OIL, MODEL
KEY_MISC2	BASELINE, WATER QUALITY, BIBLIOGRAPHY, ANNUAL REPORT, EFFLUENT, SUNCOR, SYNCRUDE, BENTHOS
KEY_MISC3	SAMPLING, PROCTER AND GAMBLE, ANC, SLAVE LAKE, HYDROLOGY

AUTHOR	HydroQual Consultants Inc.
DATE	1988
DUP_DATE	
TITLE	Selection of Water-Quality Modelling Techniques for the Athabasca River Basin - Assignment #1.
OTHER1	Prepared for Alberta Environment Planning Division.
PUBLISHER	Hydroqual Consultants Inc., Calgary, Alberta.
OTHER2	November 1988. 70 pp + Appendices.

ANNOTATION This report focuses on water quality modelling for the Athabasca River Basin Planning Program. The information contained includes: 1) a review of the proceedings of a workshop held in Edmonton on April 29-30, 1988 regarding water pollution and water quality modelling issues, 2) an overview of the modelling process, 3) an examination of available models, 4) detailed recommendations relevant to the models to be used by the Athabasca River Basin Planning Committee. Appendices include: discussions of the effects of organic compounds, nutrients (nitrogen and phosphorus), and effluents in general on aquatic systems; water quality standards for the protection of aquatic life; and a water quality model.

KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	OXYGEN, ORGANICS, NUTRIENTS
KEY_ANIMAL	VERTEBRATES, INVERTEBRATES
KEY_PLANT	ALGAE, MACROPHYTES
KEY_MCROBE	BACTERIA
KEY_MEDIA	
KEY_MISC1	MODEL, PULP MILL, EFFLUENT, WATER QUALITY, ECOSYSTEM
KEY_MISC2	
KEY_MISC3	

AUTHOR	Jaakko Poyry Oy.
DATE	1990.
DUP_DATE	
TITLE	Complementary Scientific Review of the Proposed Alberta-Pacific Pulp Mill Project Environmental Impact Assessment, Main Report.
OTHER1	Prepared for Alberta Research Council, ARC Contribution Series 1855. June 1990.
PUBLISHER	
OTHER2	

ANNOTATION

This report was "carried out to study the earlier environmental impact assessment on the proposed Alberta-Pacific Pulp Mill Project (Athabasca River), and to find complementary scientific data to better assess the potential and probable effects of the proposed development. The team also reviewed the effluent releases and water pollution control measures in the context of the entire Athabasca and Peace River watersheds.... The terms of reference for this project were to review all of the available data on the effects of chlorinated organic compounds and the biological oxygen demand that would be discharged in the pulp mill effluents.... The review has attempted to provide a detailed environmental evaluation of all pulp mills in the study area so that an assessment can be made of the potential cumulative effects" (cited from document).

Water quality characteristics reviewed included nutrients, oxygen demand, physical parameters, metals, non-metal inorganics and organics. The toxicity of these various contaminants was also discussed.

KEY_WATER	ATHABASCA, PEACE
KEY_GEOG	ALBERTA
KEY_PARAM	TOXIC, ORGANICS, OXYGEN DEMAND, METAL, NON-METAL INORGANICS, PHYSICAL PARAMETERS, OXYGEN, NUTRIENTS
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	ALGAE, CHLOROPHYLL
KEY_MCROBE	
KEY_MEDIA	EFFLUENT
KEY_MISC1	PULP MILL, RIVER, ALBERTA-PACIFIC, EIA, EFFLUENT, ORGANOCHLORINE, FISH, NUTRIENT, WATER QUALITY
KEY_MISC2	PROCTER & GAMBLE, WELDWOOD, DAISHOWA, ALBERTA-PACIFIC
KEY_MISC3	

AUTHOR	Kloepper-Sams, P., T. Marchant, J. Bernstein and S. Swanson.
DATE	1991.
DUP_DATE	
TITLE	Use of Fish Biomarkers and Exposure Measures to Assess Fish Health at a Canadian Bleached Kraft Mill Site.
OTHER1	In: Environmental Fate and Effects of Bleached Pulp Mill Effluents, Swedish Environmental Protection Agency Report 4031.
PUBLISHER	Swedish Environmental Protection Agency
OTHER2	

ANNOTATION

"Several physiological and biochemical measures ("biomarkers") were used to evaluate the health of natural fish populations exposed to bleached kraft mill effluent (BKME) in the Wapiti-Smoky River system in Alberta, Canada. Chemical and biomarker data were obtained from longnose sucker and mountain whitefish individuals and used to evaluate cause and effect relationships. There were no significant histopathological differences for either species between the exposed and reference river systems. Suckers in the Wapiti exhibited no significant differences in estradiol or testosterone serum levels when prespawners, spawners, and postspawners were compared with those in the reference river. P450IA was induced to a greater extent in whitefish than in suckers over several seasons. While P450IA induction in whitefish correlated well with some BKME exposure measures, there was no correlation with liver or gonad weights, histopathology, reproductive capacity, or population level parameters. In contrast to studies at historically degraded pulp mill sites, P450IA induction is the only major response found to date at this site and could thus be best classified as a biomarker of exposure to BKME" (cited from document abstract).

KEY_WATER	WAPITI, SMOKY
KEY_GEOG	ALBERTA, GRANDE PRAIRIE
KEY_PARAM	TOXIC, ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	BIOTA, WATER, SEDIMENT
KEY_MISC1	FISH, BENTHOS, ORGANOCHLORINE, PULP MILL, PROCTER & GAMBLE, RIVER, WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Lock, M.A., R.R. Wallace, D.R. Barton and S. Charlton.
DATE	1981.
DUP_DATE	
TITLE	The Effects of Synthetic Crude Oil on Microbial and Macroinvertebrate Benthic River Communities: Part II - The Response of an Established Community to Contamination by Synthetic Crude Oil.
OTHER1	In Environmental Pollution (Series A) 24(1981): 263-275, edited by Kenneth Mellanby.
PUBLISHER	Applied Science Publishers Ltd., Essex, England.
OTHER2	
ANNOTATION	The effects of synthetic crude oil and its major components (naphtha, kerosene and gas/oil) on benthic macroinvertebrates, algae and bacteria were tested in the Muskeg River, northeastern Alberta, using limestone bricks as substrates. Oiled and unoiled bricks were studied for 161 days in 1977.
KEY_WATER	MUSKEG, ATHABASCA
KEY_GEOG	FORT MCMURRAY, ATHABASCA, ALBERTA
KEY_PARAM	ORGANICS, NUTRIENTS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	BACTERIA
KEY_MEDIA	WATER
KEY_MISC1	OIL, RIVER, BENTHOS, SPILL, STUDIES, CONTAMINANT, NUTRIENT
KEY_MISC2	
KEY_MISC3	

AUTHOR	Luoma, M.E. and R.M. Shelast.
DATE	1988
DUP_DATE	
TITLE	Baseline Benthic Invertebrate Monitoring Study on the Athabasca and McLeod Rivers Near Whitecourt, Alberta, 1987.
OTHER1	Prepared for Millar Western Pulp Ltd., Edmonton, Alberta.
PUBLISHER	Beak Associates Consulting Ltd., Calgary, Alberta.
OTHER2	April 1988. Project No. 10-185-01-01. 44 pp. + Appendices.
ANNOTATION	Pre-operational baseline benthic invertebrate sampling (using a modified Neill-Hess cylinder) was conducted during June 2-7 and November 13-16, 1987 (after completion of diffuser installation) at 10 sites (five replicates per site) on the McLeod and Athabasca Rivers in the vicinity of the ANC and Millar Western effluent and Town of Whitecourt sewage discharges. Contaminant data available for water but not invertebrates.
KEY_WATER	ATHABASCA, MCLEOD
KEY_GEOG	WHITECOURT, ALBERTA
KEY_PARAM	EXTENSIVE
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	BIOTA, WATER
KEY_MISC1	RIVER, PULP MILL, BENTHOS, MONITORING, MILLAR WESTERN, WATER QUALITY, SAMPLING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Luoma, M.E. and R.M. Shelast.
DATE	1989
DUP_DATE	
TITLE	Baseline Benthic Invertebrate Monitoring Study on the Athabasca and McLeod Rivers, Whitecourt, Alberta, 1988.
OTHER1	Prepared for Millar Western Pulp Ltd., Whitecourt, Alberta.
PUBLISHER	Beak Associates Consulting Ltd., Calgary, Alberta.
OTHER2	October 1989. Project No. 10-209-01-01. 47 pp. + Appendices.
ANNOTATION	Benthic invertebrate sampling (using a modified Neill-Hess cylinder) was conducted during June 1-4 and October 16-21, 1988 at 10 sites (five replicates per site) on the McLeod and Athabasca Rivers in the vicinity of the ANC and Millar Western effluent and Town of Whitecourt sewage discharges. The spring measured pre-operational conditions and the fall measured operational conditions although effluent discharge was not at capacity. Contaminants were not determined in biota, but study included water sampling and analysis.
KEY_WATER	ATHABASCA, MCLEOD
KEY_GEOG	WHITECOURT, ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	BIOTA, WATER
KEY_MISC1	RIVER, PULP MILL, BENTHOS, MONITORING, MILLAR WESTERN, WATER QUALITY, SAMPLING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Luoma, M.E. and R.M. Shelast.
DATE	1990
DUP_DATE	a.
TITLE	Benthic Invertebrate Monitoring Study on the Athabasca and McLeod Rivers, Whitecourt, Alberta, 1989.
OTHER1	Prepared for Millar Western Pulp Ltd., Whitecourt, Alberta.
PUBLISHER	Beak Associates Consulting Ltd., Calgary, Alberta.
OTHER2	September 1990. Project No. 09-007-01-01. 54 pp. + Appendices.

ANNOTATION

Benthic invertebrate and water quality sampling was conducted in June 22-25 and October 6-9, 1989 to provide pre-operational data for the Athabasca River above and below the ANC CTMP mill. Five replicate samples were collected at seven sites using a modified Neill-Hess cylinder sampler. The physical characteristics of the substrates sampled were recorded. Contaminants were not determined in biota, but water quality analyses were included.

KEY_WATER	ATHABASCA, MCLEOD
KEY_GEOG	WHITECOURT, ALBERTA
KEY_PARAM	EXTENSIVE
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE, MACROPHYTE
KEY_MCROBE	
KEY_MEDIA	BIOTA, WATER
KEY_MISC1	RIVER, PULP MILL, BENTHOS, MONITORING, MILLAR WESTERN, EFFLUENT, SAMPLING, SEWAGE TREATMENT, SURVEY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Luoma, M.E. and R.M. Shelast.
DATE	1990
DUP_DATE	b.
TITLE	Benthic Invertebrate Monitoring Study and Fish Habitat Assessment on the Athabasca River, Whitecourt, Alberta, 1989.
OTHER1	Prepared for Alberta Newsprint Company Ltd., Whitecourt, Alberta.
PUBLISHER	Beak Associates Consulting Ltd., Calgary, Alberta.
OTHER2	June 1990. Project No. 9-009-01-01. 54 pp. + Appendices.
ANNOTATION	Benthic invertebrate and water quality sampling were conducted in June 22-25 and October 6-10, 1989 to provide pre-operational data for the Athabasca River above and below the ANC CMTP mill. Five replicate samples were collected at seven sites using a modified Neill-Hess cylinder sampler. The physical characteristics of the substrates sampled were recorded. Water quality analyses were included.
KEY_WATER	ATHABASCA
KEY_GEOG	WHITECOURT, ALBERTA
KEY_PARAM	EXTENSIVE
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	RIVER, PULP MILL, BENTHOS, MONITORING, ANC
KEY_MISC2	
KEY_MISC3	

AUTHOR	Luoma, M.E. and R.M. Shelast.
DATE	1990
DUP_DATE	c.
TITLE	A Benthic Invertebrate Monitoring Study on the Athabasca River, Whitecourt, Alberta, 1989.
OTHER1	Prepared for Alberta Newsprint Company, Whitecourt, Alberta.
PUBLISHER	Beak Associates Consulting Ltd., Calgary, Alberta.
OTHER2	June 1990.

ANNOTATION

This report presents baseline benthic invertebrate monitoring data that was collected for the Alberta Newsprint Company, as part of the permit requirements for the construction of a proposed chemi-thermomechanical newsprint mill near Whitecourt, Alberta.

Sampling locations extend from just upstream of the proposed ANC mill site to 33 km downstream of the proposed mill outfall. Collections were made in June and October, 1989. Water quality field measurements were taken. Water samples were collected and analysed. Invertebrate samples were collected, but were not analyzed for contaminants.

KEY_WATER	ATHABASCA
KEY_GEOG	WHITECOURT, ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN DEMAND
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	ANC, PULP MILL, EFFLUENT, SAMPLING, WATER QUALITY, RIVER, BENTHOS, MONITORING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Luoma, M.E. and R.M. Shelast.
DATE	1991
DUP_DATE	a.
TITLE	A Benthic Invertebrate Monitoring Study and Fish Habitat Assessment on the Athabasca River, Whitecourt, Alberta, 1990.
OTHER1	Prepared for Alberta Newsprint Company, Whitecourt, Alberta.
PUBLISHER	Beak Associates Consulting Ltd., Calgary, Alberta.
OTHER2	June 1990.

ANNOTATION

This report presents the results of monitoring the Athabasca River in March and October of 1990. The objectives of this study were to "establish spring pre-operational and fall post-operational (start-up) conditions in the Athabasca River" (cited from document).

Sampling locations extend from just upstream of the ANC mill site to 33 km downstream of the mill outfall.
Water quality field measurements were taken. Water samples were collected and analysed for parameters associated with treated effluent discharge. Invertebrate samples were collected (using a Neill-Hess cylinder). Contaminants were not measured in biota.

KEY_WATER	ATHABASCA
KEY_GEOG	WHITECOURT, ALBERTA
KEY_PARAM	EXTENSIVE
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	BIOTA, WATER
KEY_MISC1	BENTHOS, RIVER, MONITORING, ANC, WATER QUALTIY, SAMPLING, PULP MILL, EFFLUENT
KEY_MISC2	
KEY_MISC3	

AUTHOR	Luoma, M.E. and R.M. Shelast.
DATE	1991
DUP_DATE	b.
TITLE	Benthic Invertebrate Monitoring Study on the Athabasca and McLeod Rivers Near Whitecourt, Alberta, 1990.
OTHER1	Prepared for Millar Western Pulp Ltd.
PUBLISHER	Beak Associates Consulting Ltd., Calgary, Alberta.
OTHER2	April 1991. Project No. 09-020-01-01. 63 pp. + Appendices.
ANNOTATION	Benthic invertebrate sampling (using a modified Neill-Hess cylinder) was conducted during May 14-17, and October 11-15, 1990 at 8 sites (5 replicates per site) on the McLeod and Athabasca Rivers in the vicinity of the ANC and Millar Western effluent and Town of Whitecourt sewage discharges. Contaminants were not determined in biota, but this monitoring also included water sampling and analysis.
KEY_WATER	ATHABASCA, MCLEOD
KEY_GEOG	WHITECOURT, ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN DEMAND, OXYGEN, ORGANICS, METALS, NON-METAL INORGANICS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	BIOTA, WATER
KEY_MISC1	RIVER, PULP MILL, BENTHOS, MONITORING, MILLAR WESTERN, SURVEY, EFFLUENT, SAMPLING, WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Luoma, M.E. and R.M. Shelast.
DATE	1992
DUP_DATE	a.
TITLE	A Benthic Invertebrate Monitoring Study on the Athabasca and McLeod River, Whitecourt, Alberta, 1991.
OTHER1	Prepared for Millar Western Pulp Ltd., Whitecourt, Alberta.
PUBLISHER	SENTAR Consultants Ltd., Calgary, Alberta.
OTHER2	November 1992.

ANNOTATION

Benthic samples were collected May 20-23, 1991 and October 1-4, 1991. Eight sites were sampled: one on the McLeod River, and seven on the Athabasca River. Water quality field measurements were taken. Water samples were collected and analysed for parameters associated with treated effluent discharge.

Invertebrate samples were collected (using a Neill-Hess cyclinder), sorted and identified (to Genus where possible) and counted. Standing crop and Shannon-Weaver species diversity were calculated. Analysis of variance determined differences in numbers of taxa and organisms between sites. All benthic data were analyzed using Reciprocol Averageing Ordination in conjunction with a trophic guild analysis. Comparison was made between pre-operational and post-operational surveys to further assess the effects of pulp mill effluent on benthic invertebrates. Contaminant data available for water but not invertebrates.

KEY_WATER	ATHABASCA
KEY_GEOG	WHITECOURT, ALBERTA
KEY_PARAM	EXTENSIVE
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	MILLAR WESTERN, PULP MILL, EFFLUENT, SAMPLING, WATER QUALITY, RIVER, BENTHOS
KEY_MISC2	
KEY_MISC3	

AUTHOR	Luoma, M.E. and R.M. Shelast.
DATE	1992
DUP_DATE	b.
TITLE	A Benthic Invertebrate Monitoring Study on the Athabasca River, Whitecourt, Alberta, 1991.
OTHER1	Prepared for Alberta Newsprint Company, Whitecourt, Alberta.
PUBLISHER	Beak Associates Consulting Ltd., Calgary, Alberta.
OTHER2	March 1992.

ANNOTATION This 1991 benthic monitoring program monitored the conditions in the Athabasca River. Sampling locations extend from just downstream of the ANC mill site to 33 km downstream of the mill outfall. Water quality field measurements were taken. Water samples were collected and analysed for parameters associated with treated effluent discharge. Invertebrate samples were collected (using a Neill-Hess cylinder). Contaminants were not measured in biota.

KEY_WATER	ATHABASCA
KEY_GEOG	WHITECOURT, ALBERTA
KEY_PARAM	EXTENSIVE
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	ANC, PULP MILL, EFFLUENT, SAMPLING, WATER QUALITY, RIVER
KEY_MISC2	
KEY_MISC3	

AUTHOR	Lutz, A. and M. Hendzel.
DATE	1977.
DUP_DATE	
TITLE	A Survey of Baseline Levels of Contaminants in Aquatic Biota of the AOSERP Study Area.
OTHER1	Prepared for Alberta Oil Sands Environmental Research Program.
PUBLISHER	Fisheries and Environment Canada. Freshwater Institute.
OTHER2	AOSERP Report 17. Project AF 2.1.1. 51 pp.
ANNOTATION	"Analyses are given for up to 12 metals and 4 pesticides with PCBs, of aquatic environmental samples from 15 study sites along or near the Athabasca River from Fort McMurray north to the confluence of the Peace and Slave Rivers. There were 560 fish (8 species), 15 water, 14 sediments and a few phytoplankton and invertebrate samples. Methods of analysis (by AAS and GLC) are outlined, and standard deviations and detection limits given. In a few cases, where suspected, elevated concentrations of metals and pesticides are discussed" (as cited in document).
KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	METALS, TOXIC, ORGANICS, CHLORINATED ORGANICS
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA, SEDIMENT
KEY_MISC1	OIL, FISH, BENTHOS, CONTAMINANTS, BASELINE, SAMPLING, STUDIES
KEY_MISC2	
KEY_MISC3	

AUTHOR	MacDonald, D.D. and S.L. Smith.
DATE	1990.
DUP_DATE	
TITLE	An Approach to Monitoring Ambient Environmental Quality in the Slave River Basin, Northwest Territories: Toward a Consensus.
OTHER1	Prepared for Water Resources Division, Renewable Resources and Environment, Indian and Northern Affairs Canada.
PUBLISHER	MacDonald Environmental Sciences Ltd., Ladysmith, British Columbia.
OTHER2	

ANNOTATION "The territorial portion of the Slave River basin is a pristine watercourse which provides a host of benefits to Canadians, in general, and residents of the NWT, in particular. The system supports a variety of economically and sociologically important water uses. Specifically, the Slave River provides raw water for domestic water supply and an abundance of aquatic life that are essential to local area residents. Recreation is an emerging water use in the basin that has the potential to benefit residents and visitors to the area, alike.

...The present report provides a framework for environmental quality monitoring in the Slave River by incorporating the suggestions from the Strategy Session into the draft monitoring program design recommended by MacDonald (1990). The resultant integrated multi-media monitoring program is designed to provide baseline data on levels of contaminants in water, suspended sediment and biota in the territorial portion of the Slave River basin. As such, the monitoring program design provides recommendations on the location of sampling sites, sampling frequency, sampling methods, sample archiving, and quality assurance/quality control. In addition, a complete listing of variables which should be measured in each environmental compartment (ie. water, suspended sediment, and biota) is provided" (as cited in document).

KEY_WATER	SLAVE
KEY_GEOG	NORTHWEST TERRITORIES
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN, NON-METAL INORGANICS, ORGANICS, TOXIC, METALS
KEY_ANIMAL	INVERTEBRATE, VERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	ORGANOCHLORINE, RIVER, BASIN, SAMPLING, MONITORING,

	MODEL, WATER QUALITY, FISH, CONTAMINANT
KEY_MISC2	REPRODUCTION, BIOACCUMULATION, ECOSYSTEM, GEOLOGY, NUTRIENT
KEY_MISC3	

AUTHOR MacDonald, G. and B.R. Taylor.
DATE 1990.
DUP_DATE
TITLE Implementation of Water Quality Models for the Wapiti-Smoky and Peace River Systems.
OTHER1 Prepared for Alberta Environment, Standards and Approvals Division.
PUBLISHER HydroQual Canada Ltd.
OTHER2 127 pp + Appendices.

ANNOTATION Water quality models were implemented to evaluate the effects of pulp mill effluents on the Wapiti, Smoky and Peace Rivers. The model input file uses information collected by Alberta Environment in 1988 and 1989 for the Peace River, and in 1989 and 1990 for the Wapiti-Smoky Rivers. The collected data include: river flow, effluent quality and quantity, dissolved oxygen, sediment oxygen demand, biochemical oxygen demand, suspended solids, and water chemistry.

The water chemistry analyses include the following parameters: colour, organics, toxic organics, metals, ions, non-filterable residue, total nitrogen and total phosphorus. Data as concentrations (mg/L) and effluent loads (kg/day) are provided. Future model applications and recommendations are outlined. A hydraulic analysis (by NANUK Engineering, 1990) is included in the Appendix.

KEY_WATER WAPITI, SMOKY, PEACE
KEY_GEOG GRANDE PRAIRIE, PEACE RIVER, ALBERTA
KEY_PARAM METAL, NON-METAL INORGANICS, ORGANICS, OXYGEN, OXYGEN DEMAND, TOXIC
KEY_ANIMAL
KEY_PLANT
KEY_MCROBE
KEY_MEDIA EFFLUENT, SEDIMENT, WATER
KEY_MISC1 PULP MILL, EFFLUENT, RIVER, MODEL, WATER QUALITY
KEY_MISC2
KEY_MISC3

AUTHOR	Mah, F.T.S., D.D. MacDonald, S.W. Sheehan, T.M. Tuominen and D. Valiela.
DATE	1989.
DUP_DATE	
TITLE	Dioxins and Furans in Sediment and Fish from the Vicinity of Ten Inland Pulp Mills in British Columbia.
OTHER1	
PUBLISHER	Water Quality Branch, Inland Waters, Conservation and Protection, Pacific and Yukon Region, Environment Canada, Vancouver, B.C.
OTHER2	May 1989.
ANNOTATION	"Bed sediments and fish were collected upstream and downstream of ten pulp mills in the interior of British Columbia and analysed for dioxins and furans....Fish samples (generally composed of composites of muscle tissue from seven fish) exhibited higher levels of dioxins and furans in fish collected downstream than upstream of the mills....Highest levels of dioxins and furans were found in whitefish (Proposium williamsoni and Coregonus clupeaformis) and squawfish (Ptychocheilus oregonesis). There was a significant positive correlation between furan concentration and lipid content of fish muscle tissue" (cited from document abstract).
KEY_WATER	FRASER
KEY_GEOG	BRITISH COLUMBIA
KEY_PARAM	CHLORINATED ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	SEDIMENT, EFFLUENT, BIOTA, WATER
KEY_MISC1	PULP MILL, EFFLUENT, FISH, IMPACT, FATE, SAMPLING, CONTAMINANT, DIOXINS, FURANS, SALMONID, SURVEY,
KEY_MISC2	RIVER
KEY_MISC3	

AUTHOR McCart, P., P. Tsui, W. Grant and R. Green.
DATE 1977.
DUP_DATE
TITLE Baseline Studies of Aquatic Environments in the Athabasca River near Lease 17. Volume 1: Baseline Studies.
OTHER1 Environmental Research Monograph 1977-2.
PUBLISHER Syncrude Canada Ltd., Edmonton, Alberta.
OTHER2

ANNOTATION This baseline study of the Athabasca River was carried out in 1974 and 1975 at the request of Syncrude Canada Limited in the vicinity of Lease Number 17, which borders the west bank of the Athabasca River north of Fort McMurray. Benthic invertebrates were collected from 15 stations using artificial substrate samplers and a modified Ekman-type grab sampler. Three replicates were usually collected at each site monthly from June to October, 1975. Periphyton samples were collected monthly from December 1974 to October 1975 using glass microscope slides as artificial substrates. Periphyton biomass was estimated and taxa were identified and enumerated. The baseline also included water quality and a fisheries study. Species were collected by electrofishing.

KEY_WATER ATHABASCA
KEY_GEOG FORT MCMURRAY, ALBERTA
KEY_PARAM
KEY_ANIMAL VERTEBRATE, INVERTEBRATE
KEY_PLANT ALGAE
KEY_MCROBE
KEY_MEDIA WATER, BIOTA
KEY_MISC1 FISH, BENTHOS, RIVER, BASELINE, SYNCRUDE, OIL, WATER QUALITY, SURVEY
KEY_MISC2
KEY_MISC3

AUTHOR	McCart, P., P. Tsui, W. Grant, R. Green and D. Tripp.
DATE	1978.
DUP_DATE	
TITLE	Baseline Study of the Water Quality and Aquatic Resources of the Mackay River, Alberta.
OTHER1	Environmental Research Monograph 1978-4.
PUBLISHER	Syncrude Canada Ltd., Edmonton, Alberta.
OTHER2	

ANNOTATION This baseline study of the MacKay River, a tributary to the Athabasca River, includes water quality, periphyton, benthic macroinvertebrate, fish and habitat data collected in 1977 and/or 1978. Three sampling techniques were used for periphyton and two methods, Surber sampler and artificial substrate, were used for invertebrates. Stations at the upper, middle and lower reaches of the river were sampled.

KEY_WATER	MACKAY
KEY_GEOG	ALBERTA
KEY_PARAM	
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	FISH, RIVER, BENTHOS, BASELINE, OIL, SYNCRUDE, SURVEY, WATER QUALITY, NUTRIENT, SAMPLING
KEY_MISC2	
KEY_MISC3	

AUTHOR	McCubbin, N. and J. Folke.
DATE	1992.
DUP_DATE	
TITLE	Review of Literature on Characteristics of Effluent from Pulp and Paper Mills in Northern River Basins of Alberta, BC and Northwest Territories.
OTHER1	Prepared for Northern River Basins Study.
PUBLISHER	N. McCubbin Consultants Inc., Foster, Quebec.
OTHER2	Project No. 2085. 84 pp.

ANNOTATION

"This report is a brief overview of the literature on the characteristics of pulp and paper mill effluents which are relevant to the Northern River Basins in Alberta. Topics include: 1) pulp manufacturing processes (wood preparation, kraft pulp, bleaching of kraft pulp, recovery of kraft pulping chemicals, mechanical-sulphite spectrum of pulping), 2) effluent treatment (wastewater treatment classification, biological treatment processes, nutrients, removal of metals in biological treatment), and 3) effluent characteristics (chemical characterization, general wastewater variables (including nutrients), resin acids, steroids, chelating substances, AOX, organochlorine compounds, lipophilic/neutral organochlorines, PCDD/PCDF, chlorate, metals)" (cited from document).

Summary data are provided on dioxin (pg/l, ug/day, ug/ton), AOX (kg/day, kg/t), color (kg/d, kg/t), phenols (mg/l, g/day, g/t pulp), resins and fatty acids (ug/l, kg/day, g/t), and metals (ug/l) for selected pulp mills' effluents. No data summary is given for nutrients in effluents.

KEY_WATER	ATHABASCA, SLAVE, PEACE, WAPITI
KEY_GEOG	ALBERTA, BRITISH COLUMBIA, NORTHWEST TERRITORIES
KEY_PARAM	METAL, NON-METAL INORGANICS, ORGANICS, OXYGEN, OXYGEN DEMAND, PHYSICAL PARAMETERS, TOXIC, NUTRIENTS
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, EFFLUENT
KEY_MISC1	DAISHOWA, EFFLUENT, NUTRIENT, ORGANOCHLORINE, PULP MILL, RIVER, WATER QUALITY, PROCTER & GAMBLE
KEY_MISC2	WELDWOOD, MILLAR WESTERN, SLAVE LAKE, ANC, DIOXINS
KEY_MISC3	

AUTHOR	McGregor, C. and P. Cary.
DATE	1991
DUP_DATE	(Draft).
TITLE	Peace/Athabasca/Slave River Basins, P A S - Northern Rivers, Inventory and Evaluation, Summary of Existing Information.
OTHER1	August 21, 1991.
PUBLISHER	Planning Division, Alberta Environment.
OTHER2	

ANNOTATION This database contains existing information regarding the Peace, Athabasca and Slave River basins. Areas covered include: biophysical studies (invertebrates, vertebrates, geology, hydrology, water quality), modifications (drainage, flood control, structures), planning studies (bibliographies, economics, policy, land use, waste management, water use), and resource studies (coal, hydropower, oil, gas, sand, gravel, tar sands). Each entry contains the bibliographical reference as well as a reference number and an annotation.

KEY_WATER	PEACE, ATHABASCA, SLAVE, PEMBINA, STURGEON, NORTH SASKATCHEWAN, CLEARWATER, LESSER SLAVE
KEY_GEOG	ATHABASCA, FORT MCMURRAY, ALBERTA
KEY_PARAM	
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	INVENTORY, DATABASE, PULP MILL
KEY_MISC2	
KEY_MISC3	

AUTHOR	McLeay, D. and Associates Ltd.
DATE	1987.
DUP_DATE	
TITLE	Aquatic Toxicity of Pulp and Paper Mill Effluent: A Review.
OTHER1	Prepared for Environment Canada, Fish and Oceans Canada, Can. Pulp and Paper Association, and Ontario Ministry of the Environment.
PUBLISHER	Environment Canada.
OTHER2	Report EPA 4/pf/1. 191 pp.

ANNOTATION "This report was prepared for Environment Canada, Fisheries and Oceans Canada, the Canadian Pulp and Paper Association, and the Ontario Ministry of the Environment, as part of their shared effort to gain an understanding of current knowledge, concerns and monitoring techniques associated with the aquatic toxicity of pulp and paper mill effluents. The report constitutes an objective review and evaluation of publicly available documents and published reports that deal with this subject. The intent of the review was to undertake a critical assessment of the literature specific to the following topics: a) toxic constituents in mill effluents, receiving waters and sediments; b) laboratory monitoring for toxicity; c) toxic effects of mill effluents within receiving waters; d) bioaccumulation and elimination of organic constituents in mill effluents; and e) bioassay tests for predicting the impact of whole mill effluents in the aquatic environment" (cited from document preface).

KEY_WATER	
KEY_GEOG	CANADA
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN, TOXIC
KEY_ANIMAL	INVERTEBRATE, VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, EFFLUENT, BIOTA, SEDIMENT
KEY_MISC1	PULP MILL, EFFLUENT, FISH, FATE, BIOACCUMULATION
KEY_MISC2	
KEY_MISC3	

AUTHOR	Monenco Consultants Ltd.
DATE	1987
DUP_DATE	
TITLE	Athabasca River Basin Study. Water Quality Component. Task 6C Mainstream and Tributary Loading Forecasts. Vol. 1. Summary of Loadings.
OTHER1	
PUBLISHER	Planning Division, Alberta Environment.
OTHER2	October, 1987; 195 pp.
ANNOTATION	"Identifies and forecasts pollutant loadings from point and non-point sources to 11 areas of the Athabasca River Basin. Point Loadings include sanitary sewage, storm sewage and industrial waste water. Non-point source loadings were estimated from a water quality database" (cited from McGregor and Cary, 1991).
KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	EXTENSIVE
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	WATER QUALITY, RIVER, SEWAGE TREATMENT
KEY_MISC2	
KEY_MISC3	

AUTHOR	Monenco Consultants Ltd.
DATE	1990
DUP_DATE	a.
TITLE	Environmental Monitoring Studies in the Vicinity of the Peace River Pulp Company Mill at Peace River, Alberta, July, 1989.
OTHER1	Prepared for Daishowa-Marubeni International Ltd.
PUBLISHER	Monenco Consultants Ltd., Calgary, Alberta.
OTHER2	January 1, 1990.
ANNOTATION	A water quality and benthic invertebrate survey was conducted on the Peace and Smoky rivers upstream and downstream of the Daishowa Peace River Pulp Division mill during July 7-9, 1989. A Hess cylindrical sampler was used to collect 5 replicate samples per site. Contaminants were not determined in biota.
KEY_WATER	PEACE, SMOKY
KEY_GEOG	ALBERTA, PEACE RIVER
KEY_PARAM	EXTENSIVE
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	PULP MILL, DAISHOWA, MONITORING, RIVER, BENTHOS, WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Monenco Consultants Ltd.
DATE	1990
DUP_DATE	b.
TITLE	Environmental Monitoring Studies in the Vicinity of the Peace River Pulp Company Mill at Peace River, Alberta, September 1989.
OTHER1	Prepared for Daishowa-Marubeni International Ltd.
PUBLISHER	Monenco Consultants Ltd., Calgary, Alberta.
OTHER2	February 9, 1990.
ANNOTATION	A water quality and benthic invertebrate survey was conducted at 14 sites (5 replicates per site) on the Peace and Smoky rivers upstream and downstream of the Peace River Pulp Division mill during September 26 to October 1, 1989. A Hess cylindrical sampler was used. Contaminants were not determined in biota.
KEY_WATER	PEACE
KEY_GEOG	ALBERTA
KEY_PARAM	EXTENSIVE
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	PULP MILL, MONITORING, DAISHOWA, RIVER, BENTHOS, WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Monenco Consultants Ltd.
DATE	1990
DUP_DATE	c.
TITLE	Fish Tissue and Sediment Studies in the Vicinity of the Peace River Pulp Division Mill at Peace River, Alberta, 29 September - 1 October, 1989.
OTHER1	Prepared for Daishowa-Marubeni International Ltd.
PUBLISHER	Monenco Consultants Ltd., Calgary, Alberta.
OTHER2	September 28, 1990.
ANNOTATION	This report is a "survey of chlorinated and nonchlorinated organic compounds in sediments and northern pike (Esox lucius) muscle tissue in the vicinity of the Peace River pulp mill near Peace River, Alberta.... The levels of chlorinated organics in both sediment and fish...are low...[and] none of the compounds in either sediment or fish tissue could be considered a threat to human health" (cited from document).
KEY_WATER	PEACE
KEY_GEOG	ALBERTA, PEACE RIVER
KEY_PARAM	ORGANICS, CHLORINATED ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	SEDIMENT, BIOTA
KEY_MISC1	PULP MILL, DAISHOWA, MONITORING, FISH, RIVER, HUMAN HEALTH, STUDIES, SURVEY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Monenco Consultants Ltd.
DATE	1990
DUP_DATE	d.
TITLE	Environmental Monitoring Studies in the Vicinity of the Peace River Pulp Company Mill at Peace River, Alberta, April, 1990.
OTHER1	Prepared for Daishowa-Marubeni International Ltd.
PUBLISHER	Monenco Consultants Ltd., Calgary, Alberta.
OTHER2	November 15, 1990.
ANNOTATION	A water quality and benthic invertebrate survey was conducted at 11 sites (5 replicates per site) on the Peace and Smoky rivers upstream and downstream of the Daishowa Peace River Pulp Division mill during April 21-24, 1990. A Hess cylindrical sampler was used. Contaminants were not determined in biota.
KEY_WATER	PEACE, SMOKY
KEY_GEOG	ALBERTA, PEACE RIVER
KEY_PARAM	
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	DAISHOWA, PULP MILL, MONITORING, RIVER, BENTHOS, WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Monenco Consultants Ltd.
DATE	1991
DUP_DATE	a.
TITLE	Environmental Monitoring Studies in the Vicinity of the Peace River Pulp Mill at Peace River, Alberta, September, 1990.
OTHER1	Prepared for Daishowa-Marubeni International Ltd.
PUBLISHER	Monenco Consultants Ltd., Calgary, Alberta.
OTHER2	January 9, 1991.

ANNOTATION A water quality and benthic invertebrate survey was conducted at 13 sites (5 replicates per site) on the Peace and Smoky rivers 14 km upstream and 55 km downstream of the Peace River Pulp Division mill during September 17-19, 1990. A Hess cylindrical sampler was used. Water quality characteristics examined included nutrients, oxygen demand, physical parameters, metals and non-metal inorganics.

KEY_WATER	PEACE, SMOKY
KEY_GEOG	ALBERTA
KEY_PARAM	OXYGEN DEMAND, NON-METAL INORGANICS, METALS, NUTRIENTS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	PULP MILL, DAISHOWA, MONITORING, RIVER, BENTHOS, WATER QUALITY, SAMPLING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Monenco Consultants Ltd.
DATE	1991
DUP_DATE	b.
TITLE	Chlorinated Organics, Water Quality and Fisheries Survey in the Peace, Smoky and Slave Rivers, Alberta and Northwest Territories (3 volumes).
OTHER1	Prepared for Daishowa-Marubeni International Ltd.
PUBLISHER	Monenco Consultants Ltd., Calgary, Alberta.
OTHER2	April 8, 1991.
ANNOTATION	Pre-operational study for the Daishowa BKME pulp mill on the Peace River. Examined contaminant burdens of fish muscle tissue, suspended solids and bottom sediments from 110 km upstream to 700 km downstream of mill site. Sampling sites were concentrated along length of Peace River but also included the Smoky and Slave Rivers. Observed low concentrations of chlorinated organics, resin and fatty acids in all three media tested. Water testing conducted included dissolved oxygen, pH, and AOX. Physical characteristics of fish habitats sampling were described but not categorized as to their suitability for each species under study. Volume II = Appendix. Volume III = Seakem Analytical Services Laboratory Reports.
KEY_WATER	PEACE, SMOKY, SLAVE
KEY_GEOG	ALBERTA, NORTHWEST TERRITORIES
KEY_PARAM	ORGANICS, TOXIC, OXYGEN DEMAND, OXYGEN, PHYSICAL PARAMETERS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	PULP MILL, DAISHOWA, RIVER, FISH, ORGANOCHLORINE, STUDIES, EFFLUENT, MONITORING, WATER QUALITY
KEY_MISC2	HYDROLOGY, NAQUADAT
KEY_MISC3	

AUTHOR	Monenco Consultants Ltd.
DATE	1992
DUP_DATE	a.
TITLE	Environmental Monitoring Studies in the Vicinity of the Peace River Pulp Division Mill at Peace River, Alberta, April, 1991.
OTHER1	Prepared for Daishowa-Marubeni International Ltd.
PUBLISHER	Monenco Consultants Ltd., Calgary, Alberta.
OTHER2	January 3, 1992.

ANNOTATION A water quality and benthic invertebrate survey was conducted at 10 sites (5 replicates per site) on the Peace and Smoky rivers 14 km upstream and 30 km downstream of the Daishowa Peace River Pulp Division mill during April 26-30, 1991. A Hess cylindrical sampler was used. Water quality characteristics examined included nutrients, oxygen demand, physical parameters, metals and non-metal inorganics.

KEY_WATER	PEACE, SMOKY
KEY_GEOG	ALBERTA, PEACE RIVER
KEY_PARAM	OXYGEN DEMAND, PHYSICAL PARAMETERS, METALS, NON-METAL INORGANICS, NUTRIENTS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	WATER, SEDIMENT
KEY_MISC1	PULP MILL, DAISHOWA, MONITORING, RIVER, BENTHOS, SAMPLING, WATER QUALITY, HYDROLOGY, SURVEY
KEY_MISC2	EFFLUENT, IMPACT
KEY_MISC3	

AUTHOR	Monenco Consultants Ltd.
DATE	1992
DUP_DATE	b.
TITLE	Environmental Monitoring Studies in the Vicinity of the Peace River Pulp Division Mill at Peace River, Alberta, October, 1991.
OTHER1	Prepared for Daishowa-Marubeni International Ltd.
PUBLISHER	Monenco Consultants Ltd., Calgary, Alberta.
OTHER2	January 3, 1992.

ANNOTATION A water quality and benthic invertebrate survey was conducted at 13 sites (5 replicates per site) on the Peace and Smoky rivers 14 km upstream and 30 km downstream of the Daishowa Peace River Pulp Division mill during October 5-6, 1991. A Hess cylindrical sampler was used. Water quality characteristics examined included nutrients, oxygen demand, physical parameters, metals and non-metal inorganics.

KEY_WATER	PEACE, SMOKY
KEY_GEOG	ALBERTA, PEACE RIVER
KEY_PARAM	NON-METAL INORGANICS, OXYGEN DEMAND, METALS, PHYSICAL PARAMETERS, ORGANICS, OXYGEN, NUTRIENTS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	WATER, SEDIMENT
KEY_MISC1	PULP MILL, DAISHOWA, MONITORING, RIVER, WATER QUALITY, EFFLUENT, SAMPLING, BENTHOS
KEY_MISC2	
KEY_MISC3	

AUTHOR	Moore, J.W., S. Ramamoorthy and A. Sharma.
DATE	1986.
DUP_DATE	
TITLE	Mercury Residues in Fish from Twenty-Four Lakes and Rivers in Alberta.
OTHER1	
PUBLISHER	Alberta Environment Centre, Vegreville, Alberta.
OTHER2	AECV86-R4.
ANNOTATION	"This report describes methyl mercury and total mercury levels in fish collected from 24 lakes and rivers in Alberta during 1984. Analysis was conducted using a mercury hollow cathode lamp emitting monochromatic light" (as cited in document).
KEY_WATER	ATHABASCA, NORTH SASKATCHEWAN, SMOKY, WAPITI
KEY_GEOG	ALBERTA
KEY_PARAM	METAL, TOXIC
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	BIOTA, WATER
KEY_MISC1	RIVER, FISH, STUDIES, CONTAMINANT, LAKE
KEY_MISC2	
KEY_MISC3	

AUTHOR	Moraglia, V.
DATE	1985
DUP_DATE	
TITLE	Athabasca River Basin Study. Water Quality Component. Progress Report.
OTHER1	
PUBLISHER	Alberta Environment, Planning Division.
OTHER2	27 pp.
ANNOTATION	"Reviews the status of the water quality modelling and monitoring program in Athabasca Basin. Provides a basis for future work" (cited from McGregor and Cary, 1991).
KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	WATER QUALITY, RIVER, MODEL, DATABASE
KEY_MISC2	
KEY_MISC3	

AUTHOR	National Council of the Paper Industry for Air and Stream Improvement, Inc. (NCASI).
DATE	1989
DUP_DATE	a.
TITLE	Pulping Effluents in the Aquatic Environment - Part 1: A Review of the Published Literature.
OTHER1	
PUBLISHER	NCASI, New York, New York.
OTHER2	Technical Bulletin No 572. October 1989.
ANNOTATION	"This technical bulletin, the first of two containing the results of this compilation, summarizes the published information on pulping effluents (especially bleached kraft mill effluents) and the aquatic environment..... Information is included on (a) the impacts and characteristics of pulp mill effluents, (b) wastewater treatment practices, (c) the fate and transport of chemicals found in pulping effluents, and (d) the production processes that generate the chemicals found in pulp mill effluents" (cited from document).
KEY_WATER	
KEY_GEOG	
KEY_PARAM	EXTENSIVE
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	EFFLUENT, BIBLIOGRAPHY, PULP MILL, WATER QUALITY, ORGANOCHLORINE
KEY_MISC2	
KEY_MISC3	

AUTHOR	National Council of the Paper Industry for Air and Stream Improvement, Inc. (NCASI).
DATE	1989
DUP_DATE	b.
TITLE	Pulping Effluents in the Aquatic Environment: A Report of the Scientific Panel on Pulping Effluent in the Aquatic Environment.
OTHER1	
PUBLISHER	NCASI, New York, New York.
OTHER2	Special Report No. 89-08. December 1989.
ANNOTATION	Information was assembled on the available information on pulping effluents in the aquatic environment. An independent, scientific panel was asked to "examine the (a) North American data to determine whether it provided evidence of the compatibility of biologically treated effluents with healthy and productive aquatic ecosystems and (b) identify the sources of apparent contradictions between recent North American and Northern European research" (cited from document). This report contains the findings of the panel.
KEY_WATER	
KEY_GEOG	
KEY_PARAM	EXTENSIVE
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	PULP MILL, EFFLUENT, RIVER, WATER QUALITY, ORGANOCHLORINE, EXPERIMENT
KEY_MISC2	
KEY_MISC3	

AUTHOR	National Council of the Paper Industry for Air and Stream Improvement, Inc. (NCASI).
DATE	1991
DUP_DATE	
TITLE	Observations on the Bioaccumulation of 2,3,7,8-TCDD and 2,3,7,8-TCDF in Channel Catfish and Largemouth Bass and their Survival or Growth During Exposure to Biologically Treated Bleached Kraft Mill Effluent in Experimental Streams.
OTHER1	Technical Bulletin No. 611. June 1991.
PUBLISHER	NCASI, New York, New York.
OTHER2	

ANNOTATION "This report describes investigation designed to determine bioaccumulation factors for 2,3,7,8-TCDD and TCDF for channel catfish and largemouth bass exposed in experimental streams receiving biotreated bleached kraft mill effluent. The concept of using nominal concentrations to calculate BCFs or BAFs is also described and compared to BCFs or BAFs calculated using measured water concentrations." (cited from document) Catfish were exposed as free-living fish and also in cages in two streams (North Carolina). Largemouth bass were also stocked in three streams.

KEY_WATER	
KEY_GEOG	
KEY_PARAM	CHLORINATED ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	BIOACCUMULATION, CONTAMINANT, FISH, IMPACT, INVESTIGATION, RIVER, ORGANOCHLORINE, STUDIES
KEY_MISC2	
KEY_MISC3	

AUTHOR	Neill, C.R., B.J. Evans and A.W. Lipsett.
DATE	1981.
DUP_DATE	
TITLE	Circulation of Water and Sediment in the Athabasca Delta Area.
OTHER1	Prepared for the Alberta Oils Sands Environmental Research Program.
PUBLISHER	Northwest Hydrualic Consultants Ltd. and the Alberta Research Council.
OTHER2	AOSERP Report 123. 182 pp.
ANNOTATION	The objective of the study was to describe how water and sediment from the Athabasca River are distributed through the delta system and how they circulate and mix in Lake Athabasca and flow through to the Slave River, with a view to understanding the pathways and destinations of contaminants that might reach the Athabasca River. Study components included literature reviews, remote sensing interpretations, field investigations and mathematical analyses. The project was viewed as a first stage study to sketch the essentials of the system and to outline needs and methodologies for a better definition. ...Data collected included water depths, current velocities, water quality parameters, and sediment concentrations (as cited in document).
KEY_WATER	ATHABASCA, SLAVE
KEY_GEOG	ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN, NON-METAL INORGANICS
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	SEDIMENT, WATER
KEY_MISC1	RIVER, DELTA, HYDROLOGY, CONTAMINANTS, WATER QUALITY, SAMPLING, MODEL
KEY_MISC2	
KEY_MISC3	

AUTHOR	Niimi, A.J.; H.B. Lee and G.P. Kissoon.
DATE	1989
DUP_DATE	
TITLE	Kinetics of Chloroguaiacols and Other Chlorinated Phenolic Derivatives in Rainbow Trout (Salmo gairdneri)
OTHER1	
PUBLISHER	Environmental Toxicology and Chemistry, Vol. 9, pp. 649-653
OTHER2	1990

ANNOTATION "Subadult rainbow trout (Salmo gairdneri) were exposed to six dichloro to terachloroguaicols, two chlorinated vanillins and trichlorosyringol through waterborne and dietary exposure. Equilibrium concentrations were attained within 2 d in waterborne exposed fish, and bioconcentration factor (BCF) values ranged from 1 to 270 among the guaiacols, less than 5 for the chlorovanillins and 125 for trichlorosyringol. Dietary exposure indicated these chemicals are poorly absorbed and have half-lives of less than several days. Waterborne uptake appears to be the primary mode for accumulation." (from abstract)

KEY_WATER	
KEY_GEOG	
KEY_PARAM	CHLORINATED ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	EFFLUENT, PULP MILL, ECOSYSTEM, DIOXINS, FURANS, SALMONID
KEY_MISC2	
KEY_MISC3	

AUTHOR	Northern Rivers Intergovernmental Task Force.
DATE	1990
DUP_DATE	a.
TITLE	Water Resource Database Assessment for the Peace-Athabasca-Slave River Basin.
OTHER1	Report to Peace-Athabasca-Slave Basins Federal/Provincial Steering Committee.
PUBLISHER	Northern Rivers Intergovernmental Task Force.
OTHER2	June 1990. 40 pp.

ANNOTATION Between October 1989 and June 1990 the Northern River Intergovernmental Task Force prepared an overview of ongoing programs, initiatives and data gaps pertaining to the Peace-Athabasca-Slave River Basins. The objectives were to: 1) identify the jurisdictional responsibilities for water resource management, 2) assess existing and emerging water-related resource issues, 3) document existing data describing the physical, chemical and biological quality of the aquatic ecosystem, as well as the patterns of water use and development, 4) describe conditions within the aquatic environment of the study area, 5) assess the information deficiencies, 6) recommend Terms of Reference and arrange a study program to address these deficiencies. Collected data pertain to hydrology/hydraulics, water use, water quality, fisheries and wildlife.

KEY_WATER	PEACE, ATHABASCA, SLAVE
KEY_GEOG	ALBERTA
KEY_PARAM	
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	
KEY_MISC1	PULP MILL, WATER QUALITY, NUTRIENTS, RIVER, FISH, HYDROLOGY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Northern Rivers Intergovernmental Task Force.
DATE	1990
DUP_DATE	b.
TITLE	Water Resource Database Assessment for the Peace-Athabasca-Slave River Basin. Appendix.
OTHER1	Report to Peace-Athabasca-Slave Basins Federal/Provincial Steering Committee. June 1990.
PUBLISHER	
OTHER2	Appendix.

ANNOTATION

Appendices include: 1) a summary and classification of hydrological/hydraulic data collection sites, operated from 1910 to 1990, in the Slave River basin and delta, 2) water use in the Athatbasca/Peace/Slave River basins as it pertains to industrial and municipal withdrawls and licencing, 3) maps and descriptions of NAQUADAT water quality stations within the basins, 4) fisheries data for the Slave River and Great Slave Lake including life history information for identified species, and 5) annotated bibliographic information on wildlife; North of 60o and Alberta reports. Each section listed above provides an annotated bibliography.

This document provides general data on the characteristics of and uses within the basins. It does not provide specific data on contaminants.

KEY_WATER	PEACE, ATHABASCA, SLAVE
KEY_GEOG	ALBERTA, NORTHWEST TERRITORIES
KEY_PARAM	
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	
KEY_MISC1	HYDROLOGY, NAQUADAT, BIBLIOGRAPHY, LICENCE, RIVER, BASIN, FISH
KEY_MISC2	
KEY_MISC3	

AUTHOR	Noton, L.R.
DATE	1988.
DUP_DATE	
TITLE	An Overview of Water Quality in the Fort Chipewyan Area.
OTHER1	Presented at Fort Chipewyan - Fort Vermilion Bicentennial Conference, Provincial Museum of Alberta, 23-25 September 1988.
PUBLISHER	Environmental Quality Monitoring Branch, Environmental Assessment Division, Alberta Environment.
OTHER2	Session 5B: Workshop on Local Benefits/Costs and Environmental & Community Effects - Ft. Chipewyan.
ANNOTATION	This is a short workshop paper which discusses water quality issues in a general way. It contains no detailed information.
KEY_WATER	ATHABASCA, PEACE
KEY_GEOG	FORT CHIPEWYAN, ATHABASCA
KEY_PARAM	
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	
KEY_MISC1	MONITORING, WATER QUALITY, SUNCOR, FISH, OIL, EFFLUENT, CONTAMINANT, PULP MILL, HUMAN HEALTH, LAKE
KEY_MISC2	INDUSTRY, SEWAGE TREATMENT
KEY_MISC3	

AUTHOR	Noton, L.R.
DATE	1989.
DUP_DATE	
TITLE	The Peace and Athabasca River Systems: A Synopsis of Alberta Environment's Monitoring Programs and the Water Quality Effects of Existing Pulp Mill Effluents.
OTHER1	
PUBLISHER	Environmental Quality Monitoring Branch, Environmental Assessment Division, Alberta Environment, Edmonton, Alberta.
OTHER2	October 1989. 11 pp.

ANNOTATION This document outlines the extent of monitoring done to date, summarizes assessments regarding pulp mill effects, and examines the direction of future river monitoring and assessments for the Peace and Athabasca River systems. Regarding the effects of pulp mill effluent on receiving waters, the factors examined include heat, salts, nutrients, some metals, organic compounds, suspended solids, colour, odour, chlorinated organic compounds, and bacteria. Most of the monitoring is on the effects on water quality, sediment, bacteria, algae, benthic invertebrates and fish. No specific data are presented.

KEY_WATER	PEACE, ATHABASCA, WAPITI, SMOKY
KEY_GEOG	ALBERTA
KEY_PARAM	OXYGEN, ORGANICS, METAL, PHYSICAL PARAMETERS, NUTRIENTS
KEY_ANIMAL	INVERTEBRATE, VERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	BACTERIA
KEY_MEDIA	SEDIMENT
KEY_MISC1	PULP MILL, EFFLUENT, CONTAMINANT, MONITORING, RIVER
KEY_MISC2	
KEY_MISC3	

AUTHOR	Noton, L.R.
DATE	1990
DUP_DATE	
TITLE	Adsorbable Organic Halide Sampling in the Athabasca and Wapiti-Smoky Rivers, Fall and Winter 1989-1990.
OTHER1	
PUBLISHER	Environment Quality Monitoring Branch, Alberta Environment.
OTHER2	17 pp.
ANNOTATION	"Adsorbable organic halide (AOX) has become an accepted measure of chlorinated organic material, and is used to monitor and regulate bleached kraft pulp mill effluents (BKME). Two surveys on the Wapiti-Smoky river system and one on the Athabasca River were carried out in 1989-90 to assess the presence and downstream persistence of AOX. Both of these systems receive BKME" (cited from document). The BKME studied include the Weldwood mill at Hinton and the Procter & Gamble mill at Grande Prairie. AOX was measured as a concentration (mg/L) and load (kg/day). The analytical method used (#E128.0; NAQUADAT #95080L) measures both dissolved and particulate organic halogens.
KEY_WATER	ATHABASCA, WAPITI, SMOKY
KEY_GEOG	GRANDE PRAIRIE, HINTON, ALBERTA
KEY_PARAM	TOXIC, CHLORINATED ORGANICS
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	PULP MILL, EFFLUENT, PROCTER & GAMBLE, WELDWOOD, RIVER, SAMPLING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Noton, L.R.
DATE	1992
DUP_DATE	a.
TITLE	Water Quality in the Wapiti-Smoky River System Under Low-Flow Conditions 1987-1991: A Synopsis of Government Surveys and Monitoring.
OTHER1	
PUBLISHER	Environmental Quality Monitoring Branch, Environmental Assessment Division, Alberta Environment.
OTHER2	May 1992. Supplement - 3 pp. + Appendices.

ANNOTATION This report provides an update on water quality conditions in relation to pulp mill and municipal effluents in the Wapiti and Smoky River systems. Outlined are government surveys from 1987 to 1991. The surveys encompass effluent effects, water quality, sediments, benthic biota (algae and invertebrates), and fish. Some of the variables included in the surveys are physical parameters, oxygen, some metals, toxic compounds, organics, nutrients, and bacteria. Observed water quality is compared to objectives and guidelines. The appendices contain the specific water quality data. The Supplement provides brief notes and graphs that describe the water quality variables that were non-compliant with objectives or guidelines. The type of analytical codes provided is not identified.

KEY_WATER	WAPITI, SMOKY
KEY_GEOG	ALBERTA, GRANDE PRAIRIE
KEY_PARAM	OXYGEN, ORGANICS, NON-METAL INORGANICS, PHYSICAL PARAMETERS, TOXIC, METALS, NUTRIENTS
KEY_ANIMAL	INVERTEBRATE, VERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	BACTERIA
KEY_MEDIA	SEDIMENT, WATER
KEY_MISC1	PULP MILL, EFFLUENT, SEWAGE TREATMENT, WATER QUALITY, RIVER, BENTHOS, ORGANOCHLORINE
KEY_MISC2	
KEY_MISC3	

AUTHOR	Noton, L.R.
DATE	1992
DUP_DATE	b.
TITLE	Water Quality in the Wapiti-Smoky River System Under Low-Flow Conditions, 1987-1991: A Synopsis of Government Surveys and Monitoring. Supplement.
OTHER1	
PUBLISHER	Environmental Quality Monitoring Branch, Environmental Assessment Division, Alberta Environment.
OTHER2	June 1992. Supplement - 9 pp. + Appendices.

ANNOTATION

This document supplements the Synopsis as listed in the title. That Synopsis "provided a brief update on recent water quality conditions in the Wapiti-Smoky River system" (cited from Noton, 1992a). "This Supplement provides graphs and short notes on water quality variables that were non-compliant with objectives or guidelines, in order to better support the conclusions in the Synopsis and to illustrate the degree and frequency of non-compliance" (cited from document). Data on odour, color, TDS, sulphide, total chromium, manganese, total nitrogen, total phosphorus, phenolics, coliforms and 2,4-DCP are provided.

KEY_WATER	WAPITI, SMOKY
KEY_GEOG	ALBERTA, GRANDE PRAIRIE
KEY_PARAM	PHYSICAL PARAMETERS, METALS, NON-METAL INORGANICS, TOXIC, ORGANICS, OXYGEN DEMAND, NUTRIENTS
KEY_ANIMAL	INVERTEBRATE, VERTEBRATE
KEY_PLANT	ALGAE, CHLOROPHYLL
KEY_MCROBE	BACTERIA
KEY_MEDIA	WATER
KEY_MISC1	PROCTER & GAMBLE, RIVER, PULP MILL, NUTRIENT, WATER QUALITY, ORGANOCHLORINE, EFFLUENT, BENTHOS
KEY_MISC2	
KEY_MISC3	

AUTHOR	Noton, L.R. and N.R. Chymko.
DATE	1978.
DUP_DATE	
TITLE	Water Quality and Aquatic Resources of the Beaver Creek Diversion System.
OTHER1	Environmental Research Monograph 1978-3.
PUBLISHER	Syncrude Canada Ltd., Edmonton, Alberta.
OTHER2	

ANNOTATION The Beaver Creek Diversion System, a tributary to the Athabasca River, was investigated from March to November, 1977 to describe post-diversion conditions in Beaver Creek, Ruth Lake and Poplar Creek. Ten sites were sampled for physical-chemical parameters, phytoplankton, zooplankton and benthic macroinvertebrates. An Eckman dredge was used to collect macroinvertebrates. The diversion was undertaken by Syncrude Canada Ltd. to permit mining and extraction of bitumen.

KEY_WATER	BEAVER
KEY_GEOG	ATHABASCA
KEY_PARAM	
KEY_ANIMAL	INVERTEBRATE, VERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	WATER QUALITY, SURVEY, BENTHOS, FISH, SAMPLING, SYNCRUDE
KEY_MISC2	
KEY_MISC3	

AUTHOR	Noton, L.R. and R.D. Shaw.
DATE	1989.
DUP_DATE	
TITLE	Winter Water Quality in the Athabasca River System, 1988-1989.
OTHER1	
PUBLISHER	Environmental Quality Monitoring Branch, Environmental Assessment Division, Environmental Protection Services, Alberta Environment, Edmonton, Alberta.
OTHER2	August 1989. 200 pp.
ANNOTATION	"This report presents and interprets the findings of two water quality surveys that were carried out on the Athabasca River in 1988, from February to March, and three surveys that were carried out in 1989, from January to March. The objectives of these surveys were to obtain additional data that could be used for 1) water quality protection planning, 2) to define a baseline for present winter water quality conditions, and 3) to better assess the impacts of existing effluents on river water quality" (cited from document). Water quality and contaminant issues discussed include nutrients, metals, non-metal organics and organics. Methods for water quality analyses are provided in the report's appendices.
KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN, OXYGEN DEMAND, METALS, NON-METAL INORGANICS, ORGANICS, TOXIC
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	BACTERIA
KEY_MEDIA	WATER
KEY_MISC1	NAQUADAT, RIVER, PULP MILL, WATER QUALITY, EFFLUENT, SAMPLING, SURVEY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Noton, L.R., A.M. Anderson, T.B. Reynoldson and J. Kostler.
DATE	1989.
DUP_DATE	
TITLE	Water Quality in the Wapiti-Smoky River System Downstream of the Procter and Gamble Pulp Mill, 1983.
OTHER1	
PUBLISHER	Environment Quality Monitoring Branch, Alberta Environment, Edmonton, Alberta.
OTHER2	113 pp.

ANNOTATION This document assesses the "effects of the Procter & Gamble pulp mill on water quality and aquatic biota in the Smoky River" and increases the water quality data base for that river system. Sampling at various sites along the Wapiti-Smoky-Peace River System took place four times in 1983: March, May, September and November.

The parameters examined include: inorganics, organics, physical river conditions, metals, oxygen demand, acute toxicity and nutrients.

Samples of benthic macroinvertebrates, algae and bacteria were collected to study the effects of the effluent on aquatic biota. Acute toxicity of the effluent was measured by testing its lethality to rainbow trout. Possible effects on water use were also examined with respect to drinking water and municipal supply, recreation, aquatic life and agriculture. NAQUADAT codes are provided.

KEY_WATER	WAPITI, SMOKY
KEY_GEOG	ALBERTA
KEY_PARAM	METAL, NON-METAL INORGANICS, ORGANICS, OXYGEN, OXYGEN DEMAND, PHYSICAL PARAMETERS, TOXIC
KEY_ANIMAL	INVERTEBRATE, VERTEBRATE
KEY_PLANT	ALGAE, MACROPHYTE
KEY_MCROBE	BACTERIA
KEY_MEDIA	EFFLUENT, WATER
KEY_MISC1	PULP MILL, PROCTER & GAMBLE, EFFLUENT, WATER QUALITY, RIVER, NAQUADAT, FISH
KEY_MISC2	
KEY_MISC3	

AUTHOR	Oikari, A. and E. Anas.
DATE	1985
DUP_DATE	
TITLE	Chlorinated Phenolics and Their Conjugates in the Bile of Trout (Salmo gairdneri) Exposed to Contaminated Waters
OTHER1	
PUBLISHER	Bull. Environ. Contam. Toxicol. (1985) 35:802-809
OTHER2	
ANNOTATION	This laboratory study determined the concentrations of free and conjugated chlorinated phenolics in the bile of rainbow trout exposed to solutions of biologically-treated kraft pulp mill effluent. Seven individual phenolic compounds and mixtures of three phenolic compounds were studied.
KEY_WATER	
KEY_GEOG	
KEY_PARAM	CHLORINATED ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	CONTAMINANT, EFFLUENT, FISH, INVESTIGATION, PULP MILL, SALMONID
KEY_MISC2	
KEY_MISC3	

AUTHOR	Oikari, A., B. Holmbom, E. Anas, M. Miilunpalo, G. Kruzynski and M. Castren.
DATE	1985
DUP_DATE	
TITLE	Ecotoxicological Aspects of Pulp and Paper Mill Effluents Discharged to an Inland Water System: Distribution in Water, and Toxicant Residues and Physiological Effects in Caged Fish (Salmo Gairdneri).
OTHER1	
PUBLISHER	Aquatic Toxicology 6:219-239.
OTHER2	
ANNOTATION	"Simultaneous studies were conducted on concentrations of chlorinated phenolics (CP) and resin acids (RA) in bleached kraft pulp mill effluents (BKME), their distribution in the receiving water, their uptake and accumulation in the blood plasma of rainbow trout caged in the recipient, as well as short-term physiological effects developed in fish" (cited from document abstract).
KEY_WATER	
KEY_GEOG	
KEY_PARAM	TOXIC, ORGANICS, CHLORINATED ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA, EFFLUENT
KEY_MISC1	PULP MILL, EFFLUENT, FISH, BIOACCUMULATION
KEY_MISC2	
KEY_MISC3	

AUTHOR	Oikari, A., E. Anas, G. Kruzynski and B. Holmborn.
DATE	1984
DUP_DATE	
TITLE	Free and Conjugated Resin Acids in the Bile of Rainbow Trout, Salmo Gairdneri
OTHER1	
PUBLISHER	Bull. Environ. Contam. Toxicol. (1984) 33:233-240
OTHER2	
ANNOTATION	This laboratory study determined the concentrations of free and conjugated resin acids in the bile of rainbow trout exposed to biologically treated kraft pulp mill effluent, untreated effluent from a mechanical pulp mill, wood rosin and dehydroabietic acid.
KEY_WATER	
KEY_GEOG	
KEY_PARAM	ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	CONTAMINANT, FISH, SALMONID, SAMPLING, STUDIES
KEY_MISC2	
KEY_MISC3	

AUTHOR	Oikari, Aimo and Tiina Kunnamo-Ojala.
DATE	1986
DUP_DATE	
TITLE	Tracing of Xenobiotic Contamination in Water with the Aid of Fish Bile Metabolites: A Field Study with Caged Rainbow Trout (Salmo gairdneri)
OTHER1	
PUBLISHER	Aquatic Toxicology, 9 (1987) 327-341
OTHER2	
ANNOTATION	"Caging experiments were conducted using juvenile rainbow trout (Salmo gairdneri) in a lake area receiving chlorine-bleached kraft pulp mill effluents (BKME) from a single discharge pipe. The trout were exposed for 10 and 15 days at four locations downstream (1, 4, 6 and 11 km) and at one reference location upstream (2 km) from the effluent pipe. Water, blood and bile samples were collected and analysed for concentrations of seven resin acids (RA) and eight chlorphenolic (CP) compounds. Establishment of the pattern of metabolically converted xenobiotics in the bile of caged rainbow trout is both a sensitive and (semi)quantitative way to assess low levels of contamination in recipient waters." (from abstract)
KEY_WATER	
KEY_GEOG	
KEY_PARAM	OXYGEN, CHLORINATED ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	BIOACCUMULATION, FISH, SALMONID, EFFLUENT, PULP MILL, LAKE, CONTAMINANT, STUDIES
KEY_MISC2	
KEY_MISC3	

AUTHOR	Opperhuizen, Antoon and Dick T.H.M. Sijm.
DATE	1989
DUP_DATE	
TITLE	Biaccumulation and Biotransformation of Polychlorinated Dibenzo-p-Dioxins and Dibenzofurans in Fish
OTHER1	Presented at the Symposium of Environmental Toxicology and Chemistry, Pensicola, Florida
PUBLISHER	Environmental Toxicology and Chemistry, Vol. 9, pp. 175-186, 1990
OTHER2	November 9-12, 1989
ANNOTATION	"In spite of their hydrophobicity, not all polychlorinated dibenzo-p-dioxin (PCDD) and dibenzofuran (PCDF) cogeners accumulate significantly in fish or other aquatic organisms. Many PCDDs and PCDFs with four or more chlorine atoms, such as octachlorodibenzo-p-dioxin, are taken up very slowly, if at all, during aqueous exposure. The relatively low bioconcentration and biomagnification factors of lower chlorinated PCDDs and PCDFs should thus be explained by high rates of excretion, probably by biotransformation. These results support the hypothesis that biotransformation is of paramount importance for the bioaccumulation of several PCDDs and PCDFs." (taken from abstract)
KEY_WATER	
KEY_GEOG	
KEY_PARAM	CHLORINATED ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	FISH, BIOACCUMULATION, DIOXINS, FURANS, SALMONID, CONTAMINANT
KEY_MISC2	
KEY_MISC3	

AUTHOR	Owens, J.W., S.M. Swanson and D.A. Birkholz.
DATE	1993
DUP_DATE	
TITLE	Bioaccumulation of 2,3,7,8-Tetrachlorodibenzo-p-Diosxin, 2,3,7,8-Tetrachlorodibenzofuran and Extractable Organic Chlorine at a Bleached-Kraft Pulp Mill Site in a Northern Canadian River System
OTHER1	Presented at the 12th International Symposium on Chlorinated Dioxins and Related Compounds, Finland, August 1992
PUBLISHER	Environmental Toxicology and Chemistry, Vol. 13, No. 2., pp 343-354, 1994
OTHER2	Presented at the 13th Annual Meeting of the Society of Environmental Toxicology and Chemistry, Cincinnati, November 1992
ANNOTATION	"Abiotic and biotic environmental compartments in a northern Canadian river system have been analyzed for polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), and extractable organochlorines (EOCl) downstream of a bleached kraft pulp mill. The water column, deposited and suspended sediments, invertebrates, and tissues from several fish species were analyzed...Food-chain biomagnification of TCDD and TCDF was not observed in omnivorous and predatory species...Organism lipid levels alone are not sufficient to predict species-specific bioaccumulation and site-specific transport and species food choice parameters should be included in bioaccumulation models for hydrophobic compounds such as PCDDs and PCDFs." (from abstract)
KEY_WATER	SMOKY, WAPITI
KEY_GEOG	GRANDE PRAIRIE, ALBERTA
KEY_PARAM	CHLORINATED ORGANICS
KEY_ANIMAL	INVERTEBRATE, VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	SEDIMENT, WATER, BIOTA
KEY_MISC1	BIOACCUMULATION, CONTAMINANT, DIOXINS, EFFLUENT, FOOD CHAIN, FURANS, ORGANOCHLORINE
KEY_MISC2	PROCTOR & GAMBLE, PULP MILL, RIVER, SAMPLING, STUDIES
KEY_MISC3	

AUTHOR	Paasivirta, J., K. Keinola, T. Humppi, A. Karjalainen, J. Knuutinen, K. Mantykoski, et al.
DATE	1985
DUP_DATE	
TITLE	Polychlorinate Phenols, Guaiacols and Catechols in Environment
OTHER1	Depts. of Biology and Chemistry, University of Jyvaskyla
PUBLISHER	Chemosphere, Vol. 14, No. 5, pp 469-491
OTHER2	
ANNOTATION	"Emissions, bioaccumulation and possible food chain enrichment of polychlorinated phenols, guaiacols and catechols have been studied by analyses of water, snow, ash, benthic animal, fish and bird samples in Finland. Seventeen individual compounds were analyzed." (from abstract)
KEY_WATER	
KEY_GEOG	
KEY_PARAM	CHLORINATED ORGANICS
KEY_ANIMAL	INVERTEBRATE, VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	AIR, SEDIMENT, WATER, BIOTA
KEY_MISC1	BENTHOS, BIOACCUMULATION, CONTAMINANT, FISH, FOOD CHAIN, PULP MILL, SALMONID, SAMPLING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Peace-Athabasca-Slave River Basin Intergovernmental Task Force.
DATE	1991.
DUP_DATE	
TITLE	Northern River Basins Study Proposed Program Description.
OTHER1	Report on the Study Board from the Peace-Athabasca-Slave River Basin Intergovernmental Task Force.
PUBLISHER	Northern River Intergovernmental Task Force.
OTHER2	October 1991.
ANNOTATION	Description of a proposed program for the study of the cumulative effects of industrial development on the aquatic environment in the Peace-Athabasca-Slave River Basin. The study was proposed to take place from 1991-1995 and was designed to cover four components: 1) hydrology/hydraulics, 2) water quality, 3) fish and fish habitat, 4) use of aquatic resources.
KEY_WATER	PEACE, ATHABASCA, SLAVE
KEY_GEOG	ALBERTA
KEY_PARAM	
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	SEDIMENT, WATER
KEY_MISC1	RIVER, NUTRIENT, WATER QUALITY, HYDROLOGY, FISH, WATER RESOURCES, BASIN, INDUSTRY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Perrin, C.J. and M.L. Bothwell.
DATE	n.d.
DUP_DATE	
TITLE	Chlorate Discharges from Pulp Mills: An Examination of Potential Ecological Effects on River Algal Communities.
OTHER1	
PUBLISHER	Limnotek Research and Development Inc., Vancouver, B.C., and Environmental Sciences Division, National Hydrology Research Institute, Environment Canada, Saskatoon, Saskatchewan.
OTHER2	NHRI Contribution No. 92052.

ANNOTATION

Chlorine dioxide, used in the bleaching process of pulp mills, will form chlorate. It is known to have toxic effects in some marine algae. This study examines potential effects of chlorate on freshwater riverine periphytic algal communities. The study includes measurements of effects of nitrate (ug/l) on potential chlorate (ug/l) toxicity. Ammonium (ug/l) was also introduced into the experiment.

The study was conducted at an experimental facility on the South Thompson River at Chase, British Columbia. The year of this study is not actually stated anywhere in the document; however, algal data from the Columbia River is listed and dated from 1991.

KEY_WATER	THOMPSON
KEY_GEOG	BRITISH COLUMBIA
KEY_PARAM	TOXIC, NON-METAL INORGANICS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE, CHLOROPHYLL
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	EXPERIMENT, RIVER, BENTHOS, PULP MILL, WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Rogers, I.H., J.A. Servizi and C.D. Levings
DATE	1988
DUP_DATE	
TITLE	Bioconcentration of Chlorophenols by Juvenile Chinook Salmon (Oncorhynchus tshawytscha) Overwintering in the Upper Fraser River: Field and Laboratory Tests
OTHER1	Department of Fisheries and Oceans
PUBLISHER	Water Poll. Research J. Canada, Vol. 23, No. 1, 1988
OTHER2	
ANNOTATION	"Juvenile chinook salmon were sampled from August 1986 to March 1987 at stations near Prince George and Quesnel, influenced by sewage and pulp mill discharges...at reference sites in November 1986 and at Agassiz in April 1987. Fingerling chinook were exposed at 0.7 deg.C to a commercial wood preservative containing 2,3,4,5-tetrachlorophenol (TeCP) and pentachlorophenol (PCP) in the laboratory to simulate winter conditions in the upper Fraser River...Chinook salmon can bioconcentrate persistent chlorophenols and chloroguaiacols directly from cold water (<1 deg.C.)." (from abstract)
KEY_WATER	FRASER
KEY_GEOG	BRITISH COLUMBIA
KEY_PARAM	CHLORINATED ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	BASELINE, CONTAMINANT, FISH, IMPACT, INDUSTRY, PULP MILL, RIVER, SALMONID, SAMPLING
KEY_MISC2	
KEY_MISC3	

AUTHOR	SENTAR Consultants Ltd.
DATE	1993.
DUP_DATE	
TITLE	Wapiti/Smoky River Ecosystem Study.
OTHER1	Prepared for Weyerhaeuser Canada, Grande Prairie, Alberta.
PUBLISHER	
OTHER2	158 pp. + Appendices.

ANNOTATION "This report describes a 2 1/2 year, multidisciplinary study of the Wapiti/Smoky River ecosystem in northwestern Alberta. The Wapiti/Smoky River system receives effluent from the Procter & Gamble Cellulose Ltd. (now Weyerhaeuser Canada Ltd.) bleached kraft pulp mill at Grande Prairie....The main objectives of the study were to: (1) determine the fate and transport of chlorinated organic compounds in the river; (2) examine fish population parameters, as well as individual health parameters; and (3) document the fish habitat types upstream and downstream of the mill, and determine whether the mill effluent has affected habitat quality, with emphasis on spawning habitat....Water, bottom sediments, suspended sediments, fish and insects were collected for analyses of an extensive list of substances, including metals and chlorinated organic compounds. Mountain whitefish and longnose sucker were the main species examined for contaminants" (cited from document).

KEY_WATER	WAPITI, SMOKY, NORTH SASKATCHEWAN
KEY_GEOG	GRANDE PRAIRIE, ALBERTA
KEY_PARAM	OXYGEN DEMAND, PHYSICAL PARAMETERS, METALS, ORGANICS, NON-METAL INORGANICS, TOXIC
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	BIOTA, EFFLUENT, SEDIMENT, WATER
KEY_MISC1	PULP MILL, PROCTER & GAMBLE, EFFLUENT, FISH, FATE, WATER QUALITY, RIVER, CONTAMINANT, STUDIES
KEY_MISC2	SURVEY
KEY_MISC3	

AUTHOR	SENTAR Consultants Ltd.
DATE	1992
DUP_DATE	a.
TITLE	Winter Water Quality Survey on the Athabasca River, February 1992.
OTHER1	Prepared for Millar Western Pulp Ltd. and Alberta Newsprint Company, Whitecourt, Alberta.
PUBLISHER	SENTAR Consultants Ltd., Calgary, Alberta.
OTHER2	July 1992. Project No. 09-614-01-01.
ANNOTATION	A 2-day winter water quality monitoring survey on the Athabasca River was conducted during February 1992. This survey was part of an ongoing monitoring program for Millar Western Pulp Ltd. and Alberta Newsprint Company. Parameters measured include dissolved oxygen, BOD, specific conductance, major ions, metals, nutrients, suspended solids, color, phenols, chelators, coliforms, resin and fatty acids.
KEY_WATER	ATHABASCA
KEY_GEOG	ALBERTA, WHITECOURT
KEY_PARAM	METAL, NON-METAL INORGANICS, OXYGEN, OXYGEN DEMAND, PHYSICAL PARAMETERS, TOXIC, NUTRIENTS
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	BACTERIA
KEY_MEDIA	WATER
KEY_MISC1	RIVER, MONITORING, WATER QUALITY, SURVEY, ANC, MILLAR WESTERN, NUTRIENT, PULP MILL
KEY_MISC2	
KEY_MISC3	

AUTHOR	SENTAR Consultants Ltd.
DATE	1992
DUP_DATE	b.
TITLE	A Benthic Invertebrate Monitoring Study on the Athabasca River, Whitecourt, Alberta.
OTHER1	Prepared for Alberta Newsprint Company, Whitecourt, Alberta.
PUBLISHER	SENTAR Consultants Ltd.
OTHER2	
ANNOTATION	Benthic invertebrate and water quality sampling was conducted on May 20-22 and October 1-3, 1991 on the Athabasca River above and below the ANC CTMP mill. Five replicate samples were collected at seven sites using a modified Neill-Hess cylindrical sampler. Water quality analyses included nutrients, physical parameters, metals, organics, oxgyen demand, dissolved oxygen and non-metal inorganics.
KEY_WATER	ATHABASCA
KEY_GEOG	WHITECOURT, ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS, METALS, ORGANICS, OXYGEN DEMAND, OXYGEN, NON-METAL INORGANICS, NUTRIENTS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	ANC, PULP MILL, EFFLUENT, SAMPLING, WATER QUALITY, RIVER
KEY_MISC2	
KEY_MISC3	

AUTHOR	Sergy, G.A. and R.G. Ruggles.
DATE	1975.
DUP_DATE	
TITLE	Toxicity of Wastewater Discharges and Their Effects on Receiving Waters at Northwest Pulp and Power Co. Ltd., Hinton, Alberta.
OTHER1	Prepared for Water Pollution Control Section, Environmental Protection Service, Environment Canada, Northwest Region.
PUBLISHER	Environment Canada.
OTHER2	Surveillance Report EPS 5-NW-75-1. January 1975. 40 pp.

ANNOTATION "Samples of waste water discharges from Northwest Pulp and Power Ltd. were collected in August of 1974, for bacteriological and chemical analysis and toxicity testing. All samples bioassayed exhibited acute lethal toxicity to rainbow trout which can be attributed to toxic components in the waste water. Benthic sampling along the banks of the Athabasca River below the main effluent outfall showed little change in diversity and density of bottom organisms except at one location below the mouth of Hardisty Creek. Benthic sampling above and below the bark pile runoff into Hardisty Creek showed drastic changes had occurred in the stream bottom conditions and in the composition of the bottom invertebrate community" (cited from document).

KEY_WATER	ATHABASCA
KEY_GEOG	HINTON, ALBERTA
KEY_PARAM	METALS, PHYSICAL PARAMETERS, OXYGEN DEMAND, TOXIC
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	BACTERIA
KEY_MEDIA	WATER, BIOTA, EFFLUENT
KEY_MISC1	PULP MILL, EFFLUENT, FISH, WATER QUALITY, BENTHOS, SAMPLING, RIVER, CONTAMINANT, FATE
KEY_MISC2	
KEY_MISC3	

AUTHOR	Servizi, James A., Robert W. Gordon and John H. Carey
DATE	1988
DUP_DATE	
TITLE	Bioconcentration of Chlorophenols by Early Life Stages of Fraser River Pink and Chinook Salmon
OTHER1	
PUBLISHER	Water Poll. Research J. Canada, Vol. 23, No. 1, 1988
OTHER2	
ANNOTATION	"Chlorophenol content of emergent pink salmon fry from five natal spawning grounds of fingerling chinook from the Fraser River was determined. Major chlorophenols identified were pentachlorophenol, 2,3,4,6-tetrachlorophenol, 2,4,5-trichlorophenol, 2,4-dichlorophenol. Sources of these compounds appear to be lumber mills using chlorophenol based fungicides and pulp and paper mill effluents...The 96-hr LC50 of a chlorophenol based fungicide to pink salmon during the egg-to-fry stage was determined to be about 100 times higher than average levels reported for Fraser River water." (from abstract)
KEY_WATER	FRASER
KEY_GEOG	BRITISH COLUMBIA
KEY_PARAM	CHLORINATED ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	FUNGI
KEY_MEDIA	SEDIMENT, WATER
KEY_MISC1	CONTAMINANT, EFFLUENT, FISH, PULP MILL, RIVER, SALMONID
KEY_MISC2	
KEY_MISC3	

AUTHOR	Servos, M.R., D.C.G. Muir, D.M. Whittle, D.B. Sergeant and G.R.B. Webster
DATE	1989
DUP_DATE	
TITLE	Bioavailability of Octachlorodibenzo-p-Dioxin in Aquatic Ecosystems
OTHER1	Department of Fisheries and Oceans and Natural Water Research Institute, Environment Canada
PUBLISHER	Chemosphere, Vol. 19, Nos. 1-6, pp 969-972
OTHER2	Department of Soil Science, University of Manitoba
ANNOTATION	"Octachlorodibenzo-p-dioxin (OCDD) was added to replicate 5 m diam. x 2 m deep lake enclosures at the Experimental Lakes Area in Northwestern Ontario. OCDD partitioned rapidly to particulate and dissolved organic matter and was removed from the water column with a half-life of 4.0 d. Only 24 d after additions to the enclosures >98% of the OCDD could be accounted for in the sediments. A detrital based food chain transfer appears to be the source of OCDD in biota although assimilation efficiency is low. OCDD concentrations in suckers (Catostomus sp.) collected below two pulp mills in western Canada ranged up to 756 ng/kg." (from abstract)
KEY_WATER	
KEY_GEOG	ONTARIO
KEY_PARAM	ORGANICS, CHLORINATED ORGANICS
KEY_ANIMAL	INVERTEBRATE, VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, SEDIMENT, BIOTA
KEY_MISC1	BENTHOS, CONTAMINANT, DIOXINS, FISH, FOOD CHAIN, PATHWAY, STUDIES
KEY_MISC2	
KEY_MISC3	

AUTHOR	Shaw, R.D. and L.R. Noton.
DATE	1989.
DUP_DATE	
TITLE	A Preliminary Assessment of the Impact of Existing Pulp Mills on the Peace River.
OTHER1	Prepared for Environmental Quality Monitoring Branch, Environmental Assessment Division, Environmental Protection Services, Alberta Environment.
PUBLISHER	Environmental Quality Monitoring Branch, Alberta Environment.
OTHER2	October 1989. 15 pp.
ANNOTATION	"In 1988, the Environmental Quality Monitoring Branch, Alberta Environment, initiated a baseline survey of water quality in the Peace River system. Based on data collected for the survey, a preliminary evaluation of the impact of the existing pulp mill effluents on the Peace River in Alberta is provided in this report....For the constituents and sites investigated in the 1988-89 surveys, there were no adverse impacts from the existing mills on the water quality of the Peace River mainstem. The lack of impacts reflects the high effluent dilution capacity of the river and/or the assimilation capacity of intervening water bodies....The persistence and effect of chlorinated organic compounds, which emanate from bleached kraft mills on sediment or aquatic biota were not examined" (cited from document).
KEY_WATER	PEACE
KEY_GEOG	ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN DEMAND, METALS, TOXIC, CHLORINATED ORGANICS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	BACTERIA
KEY_MEDIA	WATER, EFFLUENT
KEY_MISC1	PULP MILL, IMPACT, RIVER, WATER QUALITY, HYDROLOGY, CONTAMINANT
KEY_MISC2	
KEY_MISC3	

AUTHOR	Shaw, R.D., L.R Noton, A.M. Anderson, and G.W. Guenther.
DATE	1990.
DUP_DATE	
TITLE	Water Quality of the Peace River in Alberta.
OTHER1	June 1990.
PUBLISHER	
OTHER2	

ANNOTATION

Water quality samples were collected monthly during May through September 1988 and once in December 1988 and February 1989 from ten sites along the Peace River and from ten tributary rivers. A comprehensive list of physical, chemical and biological constituents were analyzed including some trace organics. Benthic invertebrates were sampled (5 replicates) using a modified Neill cylinder in September 1988 in the mainstem with some additional samples in May and September 1987 and July and October 1988. Epilithic chlorophyll a was sampled by scraping rocks in a defined area. Analyses included major ions, metals, conventional organics, nutrients and general water quality parameters.

KEY_WATER	PEACE
KEY_GEOG	ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS, ORGANICS, METALS, NON-METAL INORGANICS, NUTRIENTS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	RIVER, WATER QUALITY, BENTHOS, SAMPLING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Sodergren, A. (ed.).
DATE	1989
DUP_DATE	
TITLE	Biological Effects of Bleached Pulp Mill Effluents.
OTHER1	Final Report, Environment/Cellulose I Project.
PUBLISHER	Nat. Swedish Environ. Prot. Bd. Report #3558. 139 pp.
OTHER2	

ANNOTATION "The extent of the biological effects in aquatic ecosystems that are caused by effluents from pulp industries, especially from bleaching processes, was studied in a joint biological/chemical field project consisting of several sub-projects. The principal study was devoted to the effects of biologically-active chlorinated organic compounds.

A receiving body of water for pulp bleach plant effluents at the Baltic Sea was chosen for the three-year study" (cited from document abstract). Effluent discharges included organic bound chlorine (EOC1), chloroguaiacols, 2,3,7,8-TCDD and 2,3,7,8-TCDF.

KEY_WATER	
KEY_GEOG	
KEY_PARAM	TOXIC, CHLORINATED ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	BIOTA, WATER, EFFLUENT
KEY_MISC1	PULP MILL, EFFLUENT, FISH, FATE, STUDIES, BENTHOS
KEY_MISC2	
KEY_MISC3	

AUTHOR	Stanley Associates Engineering Ltd.
DATE	1982
DUP_DATE	
TITLE	Slave River Hydro Feasibility Study - Task Area 4B - Surface Water Quality of the Peace-Athabasca Delta.
OTHER1	
PUBLISHER	R.L. Walker & Partners Ltd.
OTHER2	
ANNOTATION	"Report defines the environmental implcation of altering the hydrological regime in the Peace-Athabasca Delta (Task Area 4B) as a result of the hydro development. One component of the study deals with the quality of surface waters within the study area. This report presents a review of existing water quality information and an assessment of potential changes to surface water are based on historical and field data from 1976-1982. Water quality data throughout the delta are of limited value and availability due mainly to lack of sampling consistency and frequency" (cited from McGregor and Cary, 1991).
KEY_WATER	PEACE-ATHABASCA, SLAVE
KEY_GEOG	
KEY_PARAM	
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	
KEY_MISC1	DELTA, RIVER, WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Suntio, Leena R., Wan Ying Shiu, Donald Mackay.
DATE	1988
DUP_DATE	
TITLE	A Review of the Nature and Properties of Chemicals Present in Pulp Mill Effluents
OTHER1	
PUBLISHER	Chemosphere, Vol. 17, No. 7, pp 1249-1290
OTHER2	
ANNOTATION	"A compilation is presented of some 250 chemicals identified in the effluents from pulp mills. The chemicals are categorized and available from data on their environmentally relevant properties tabulated, including water solubility, vapour pressure, dissociation constant, and octanol-water partition coefficient. Data are also presented on the amounts produced, bioconcentration potential, and toxicity. It is concluded that available data on individual compound properties is not adequate to permit accurate assessments of environmental fate or effects." (from abstract)
KEY_WATER	
KEY_GEOG	
KEY_PARAM	ORGANICS, CHLORINATED ORGANICS, EXTENSIVE
KEY_ANIMAL	VERTEBRATE, INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	EFFLUENT
KEY_MISC1	DATABASE, EFFLUENT, FISH, ORGANOCHLORINE, PULP MILL
KEY_MISC2	
KEY_MISC3	

AUTHOR	Swanson, S., K. Kroeker, R. Schryer, and W. Owens.
DATE	1992
DUP_DATE	
TITLE	Population Responses in Mountain Whitefish and Longnose Suckers Exposed to Bleached Kraft Mill Effluent (BKME) in Northern Alberta.
OTHER1	
PUBLISHER	19th Annual Aquatic Toxicity Workshop, October 4-7, 1992, Edmonton, Alberta.
OTHER2	

ANNOTATION "The potential BKME discharge impacts on fish populations are under study in a western Canadian river ecosystem. Seasonal biological and chemical sampling were concurrent in a 230 km BKME exposed river reach and in a reference river. Fisheries population analyses included: species abundance and distribution, growth, recruitment, age distribution, and fecundity. Chemical analyses showed that: most chlorophenolics and resin acids were rapidly degraded; hydrophoboic compounds such as 2,3,7,8-TCDD and TCDF were transported in suspended sediments; chlorinated organics measured as AOX were transported in the water column. Radiotelemetry of longnose sucker and mountain whitefish showed that both species were highly mobile. There were few significant differences in fish population parameters between the BKME exposed system and the reference, indicating that BKME has not had discernable adverse impacts at the population level" (cited from document abstract).

KEY_WATER	WAPITI
KEY_GEOG	ALBERTA, GRANDE PRAIRIE
KEY_PARAM	ORGANICS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	FISH, PULP MILL, PROCTER & GAMBLE, RIVER, WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Swanson, S., K. Kroeker, R. Schryer, R. Shelast and W. Owens.
DATE	1991
DUP_DATE	
TITLE	Chemical Fate and Characterization of Fish Populations at a Canadian Site Exposed to Bleached Kraft Mill Effluent (BKME).
OTHER1	
PUBLISHER	Proc. Conf. Environmental Fate and Effects of Bleached Pulp Mill Effluents, Stockholm, Saltsjobaden.
OTHER2	November 19-21, 1991.

ANNOTATION "The potential BKME discharge impacts on fish populations are under study in a western Canadian river ecosystem. Seasonal biological and chemical sampling were concurrent in a 300 km river reach (230 km BKME exposed) and in a reference river. Fisheries population analyses included: species abundance and distribution, growth, recruitment, age distribution, and fecundity. Chemical analyses showed that: most chlorophenolics and resin acids were rapidly degraded; hydrophobic compounds such as 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and 2,3,7,8-tetrachlorodibenzo-p-furan (TCDF) were transported in suspended sediments; chlorinated organics measured as Adsorbable Organic Halogens (AOX) were transported in the water column. Radiotelemetry of longnose sucker and mountain whitefish showed that both species were highly mobile. There were few significant differences in fish population parameters between the BKME exposed system and the reference, indicating no discernable adverse impacts from BKME at the population level" (cited from document abstract).

KEY_WATER	WAPITI, SMOKY
KEY_GEOG	ALBERTA
KEY_PARAM	TOXIC
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	RIVER, PULP MILL, PROCTER & GAMBLE, WATER QUALITY, FISH, DIOXINS, FURANS
KEY_MISC2	
KEY_MISC3	

AUTHOR	Swanson, S., R. Shelast, R. Schryer, P. Kleopper-Sams, K.Kroeker, W.Owens, and J. Bernstein.
DATE	1992
DUP_DATE	
TITLE	Fish Populations and Biomarker Responses at a Northern Alberta Bleached Kraft Pulp Mill Site.
OTHER1	Presented at CPPA Pacific-Western Technical Section Conference, May 14-16, Jasper, Alberta.
PUBLISHER	
OTHER2	
ANNOTATION	"The potential impact of bleached kraft mill effluent (BKME) discharges on fish populations and fish health has been studied in a northern Alberta riverine ecosystem. The field program mirrors federal Environmental Effects Monitoring (EEM) requirements and included seasonal chemical and biological sampling. Fisheries analyses began with species abundance and distribution and for two target species, longnose sucker and mountain whitefish, included growth, recruitment, age distribution, mortality and fecundity... Chemical body burdens were concurrently studied with biomarker responses in the target species... Biomarker measurements included blood chemistry and hematology, histopathology, sex steroid levels, and mixed function oxidase induction (P4501A)...Radiotelemetry confirmed significant mobility of both species. Therefore, the interpretation of P4501A and other biomarker results should be made cautiously without concurrent, individual chemical compound exposure analyses. In summary, BKME did not have discernible impacts on either fish populations or fish health, and P4501A induction was not predictive of biological impacts." (cited from document abstract).
KEY_WATER	WAPITI
KEY_GEOG	ALBERTA, GRANDE PRAIRIE
KEY_PARAM	ORGANICS, TOXIC
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	PROCTER & GAMBLE, RIVER, WATER QUALITY, PULP MILL, FISH, ORGANOCHLORINE
KEY_MISC2	
KEY_MISC3	

AUTHOR	Taylor, B.R., G. MacDonald and H.R. Hamilton.
DATE	1990.
DUP_DATE	
TITLE	Model Calibration and Receiving Water Evaluation for Pulp Mill Developments, Volume II: Nutrients, Resin Acids, Chelators, Phenols, Colour, Suspended Solids.
OTHER1	Prepared for: Standards and Approvals Division, Alberta Environment, Edmonton, Alberta.
PUBLISHER	HydroQual Consultants Inc., Calgary, Alberta.
OTHER2	March 1990. 92 pp.

ANNOTATION

"This report deals with the implications of existing and proposed chemithermomechanical pulp (CTMP) and Kraft mill wastewater discharges to water quality in the Athabasca River" (cited from document). Information has been compiled from monitoring that took place on the Athabasca River in January and February 1989, and used as input to water quality models. Five pulp mills on the Athabasca River were monitored: 1) Weldwood - Bleached Kraft, 2) Alberta Newsprint Company - CTMP, 3) Millar Western - CTMP, 4) Alberta Energy Company - CTMP, 5) Alberta Pacific - Bleached Kraft. The only active mills during the 1989 surveys were Weldwood and Millar Western.

The following constituents of pulp mill effluent are examined: phenols, resin acids, chelators, colour, suspended solids, and nutrients (nitrogen and phosphorus). Effects on ecosystem productivity are discussed including effects on algae, macrophytes, bacteria, invertebrates, fish eggs, and fish fry.

KEY_WATER	ATHABASCA, LESSER SLAVE
KEY_GEOG	HINTON, WHITECOURT, ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS, TOXIC, ORGANICS, NON-METAL INORGANICS, NUTRIENTS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	ALGAE, MACROPHYTE
KEY_MCROBE	BACTERIA
KEY_MEDIA	EFFLUENT, WATER
KEY_MISC1	RIVER, PULP MILL, EFFLUENT, MODEL, FISH, WELDWOOD, MILLAR WESTERN
KEY_MISC2	
KEY_MISC3	

AUTHOR	Terrestrial and Aquatic Environmental Managers (TAEM) Ltd.
DATE	1990.
DUP_DATE	
TITLE	An Historical Review of the Biological and Water Quality Surveys of the Wapiti River, 1970-1988.
OTHER1	Prepared for Procter & Gamble Cellulose, Grande Prairie, Alberta.
PUBLISHER	TAEM Ltd., Saskatoon, Saskatchewan.
OTHER2	May 1990. 32 pp. + Appendices.

ANNOTATION

This report reviews "the historic data collected through pre- and post-operational surveys conducted by P&G" and "assesses the long term trends in water quality and benthic community composition resulting from ongoing treated pulp effluent release" (cited from document). The review encompasses surveys from 1972, 1974, 1975, 1980, 1981, 1982, 1983, 1985, 1987, and 1988 conducted on the Wapiti River at varying sites in the vicinity of the Procter & Gamble Pulp Mill and Grande Prairie Sewage Treatment Plant.

Water quality data include: dissolved oxygen, oxygen demand, physical parameters and non-metal inorganics. Benthic macroinvertebrates were collected for basic data.

KEY_WATER	WAPITI
KEY_GEOG	GRANDE PRAIRIE, ALBERTA
KEY_PARAM	OXYGEN, OXYGEN DEMAND, PHYSICAL PARAMETERS, NON-METAL INORGANICS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	BIOTA, EFFLUENT, WATER
KEY_MISC1	PULP MILL, SEWAGE TREATMENT, EFFLUENT, PROCTER & GAMBLE, RIVER, WATER QUALITY, SURVEY, SAMPLING
KEY_MISC2	BENTHOS
KEY_MISC3	

AUTHOR	Terrestrial and Aquatic Environmental Managers (TAEM) Ltd.
DATE	1991
DUP_DATE	a.
TITLE	Biological and Water Quality Surveys of the Wapiti River, October 1990 and April 1991.
OTHER1	Prepared for Procter & Gamble Cellulose, Grande Prairie, Alberta.
PUBLISHER	TAEM Ltd., Saskatoon, Saskatchewan.
OTHER2	July 1991. 53 pp. + Appendices.

ANNOTATION

This report provides data from a biomonitoring survey of the Wapiti River conducted in October 1990 and April 1991. Eleven sites (six control sites, five observation sites) along 42 km of the river near Grande Prairie, Alberta were sampled for river water quality and benthic macroinvertebrates. The effluent sources in the area are the Procter & Gamble Pulp Mill and the Grande Prairie Sewage Treatment Plant.

Water quality data include: physical parameters, dissolved oxygen, BOD, non-metal inorganics, organics and nutrients. Benthic macroinvertebrates were collected for taxonomic identification, enumeration and response to the pulp effluent.

KEY_WATER	WAPITI
KEY_GEOG	GRANDE PRAIRIE, ALBERTA
KEY_PARAM	OXYGEN, OXYGEN DEMAND, PHYSICAL PARAMETERS, ORGANICS, NON-METAL INORGANICS, NUTRIENTS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	CHLOROPHYLL
KEY_MCROBE	
KEY_MEDIA	BIOTA, EFFLUENT, WATER
KEY_MISC1	PULP MILL, SEWAGE TREATMENT, EFFLUENT, PROCTER & GAMBLE, RIVER, WATER QUALITY, SURVEY, SAMPLING
KEY_MISC2	BENTHOS
KEY_MISC3	

AUTHOR	Terrestrial and Aquatic Environmental Managers (TAEM) Ltd.
DATE	1991
DUP_DATE	b.
TITLE	Biological and Water Quality Survey of the Athabasca River 1990.
OTHER1	Prepared for Weldwood of Canada Limited, Hinton, Alberta.
PUBLISHER	TAEM Ltd., Saskatoon, Saskatchewan.
OTHER2	March 1991.

ANNOTATION Athabasca River water samples and benthic invertebrate samples were collected on October 10-12, 1990 from three stations upstream of the Weldwood pulp mill effluent and six stations downstream to a distance of about 44 km below the mill outfall. Water quality parameters measured included physical parameters, oxygen demand, non-metal inorganics, oxygen, organics and nutrients. Benthic invertebrates (collected by a Neill cylinder) and epilithic chlorophyll a were measured.

KEY_WATER	ATHABASCA
KEY_GEOG	HINTON, ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN DEMAND, NON-METAL INORGANICS, OXYGEN, ORGANICS, NUTRIENTS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	BENTHOS, WATER QUALITY, EFFLUENT, HINTON, SAMPLING, RIVER, SEWAGE TREATMENT, PULP MILL
KEY_MISC2	
KEY_MISC3	

AUTHOR	Terrestrial and Aquatic Environmental Managers (TAEM) Ltd.
DATE	1991
DUP_DATE	c.
TITLE	Biological and Water Quality Survey of the Athabasca River, April 1991.
OTHER1	Prepared for Weldwood of Canada Limited, Hinton, Alberta.
PUBLISHER	TAEM Ltd., Saskatoon, Saskatchewan.
OTHER2	August, 1991.
ANNOTATION	Athabasca River water samples and benthic invertebrate samples were collected on April 17-18, 1991 from three stations upstream of the Weldwood pulp mill effluent and six stations downstream to a distance of about 44 km below the mill outfall. Water quality characteristics measured included physical parameters, oxygen demand, non-metal inorganics, dissolved oxygen, organics and nutrients. Benthic invertebrates, collected by a Neill cylinder, and epilithic chlorophyll a were also measured.
KEY_WATER	ATHABASCA
KEY_GEOG	HINTON, ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN DEMAND, NON-METAL INORGANICS, OXYGEN, ORGANICS, NUTRIENTS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	BENTHOS, WATER QUALITY, EFFLUENT, HINTON, SAMPLING, RIVER, SEWAGE TREATMENT, PULP MILL
KEY_MISC2	
KEY_MISC3	

AUTHOR	Terrestrial and Aquatic Environmental Managers (TAEM) Ltd.
DATE	1992
DUP_DATE	a.
TITLE	Benthic Macroinvertebrate and Water Quality Survey of the Wapiti River, January 1992.
OTHER1	Prepared for Procter & Gamble Cellulose, Grande Prairie, Alberta.
PUBLISHER	TAEM Ltd., Saskatoon, Saskatchewan.
OTHER2	April 1992. 40 pp + Appendices.

ANNOTATION This report provides data from a biomonitoring survey of the Wapiti River conducted in January 1992. Eleven stations along 42 km of the river near Grande Prairie, Alberta were sampled for river water quality and benthic macroinvertebrates. The effluent sources in the area are the Procter & Gamble Pulp Mill and the Grande Prairie Sewage Treatment Plant.

Water quality data include: physical parameters (including dissolved oxygen), BOD, sodium ion, colour, total residue, non-filtered residue, dissolved organic carbon, ammonia, dissolved phosphorus, and ortho-phosphate. Nutrient/organic parameters are measured as concentrations (mg/L). Approved Alberta Environment test procedures were followed for the laboratory analyses. Water samples were also collected to determine the extent of effluent mixing in the river. Benthic macroinvertebrates were collected for taxonomic identification (mostly to the genus level), enumeration, and response to the pulp effluent.

KEY_WATER	WAPITI
KEY_GEOG	GRANDE PRAIRIE, ALBERTA
KEY_PARAM	OXYGEN, OXYGEN DEMAND, PHYSICAL PARAMETERS, ORGANICS, NON-METAL INORGANICS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	BIOTA, EFFLUENT, WATER
KEY_MISC1	PULP MILL, SEWAGE TREATMENT, EFFLUENT, PROCTER & GAMBLE, RIVER, WATER QUALITY, SURVEY, SAMPLING
KEY_MISC2	BENTHOS
KEY_MISC3	

AUTHOR	Terrestrial and Aquatic Environmental Managers (TAEM) Ltd.
DATE	1992
DUP_DATE	b.
TITLE	Biological and Water Quality Survey of the Athabasca River, April 1992.
OTHER1	Prepared for Weldwood of Canada Limited, Hinton, Alberta.
PUBLISHER	TAEM Ltd., Saskatoon, Saskatchewan.
OTHER2	September, 1992.

ANNOTATION Athabasca River water samples and benthic invertebrate samples were collected on April 14-15, 1992 from three stations upstream of the Weldwood pulp mill effluent and six stations downstream to a distance of about 44 km below the mill outfall. Water quality characteristics measured included physical parameters, oxygen demand, non-metal inorganics, dissolved oxygen, organics and nutrients. Benthic invertebrates, collected by a Neill cylinder, and epilithic chlorophyll a were also measured.

KEY_WATER	ATHABASCA
KEY_GEOG	HINTON, ALBERTA
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN DEMAND, NON-METAL INORGANICS, OXYGEN, ORGANICS, NUTRIENTS
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	ALGAE
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	BENTHOS, WATER QUALITY, EFFLUENT, HINTON, SAMPLING, RIVER, SEWAGE TREATMENT, PULP MILL
KEY_MISC2	
KEY_MISC3	

AUTHOR	Walder, G.L. and D.W. Mayhood.
DATE	1985
DUP_DATE	
TITLE	An Analysis of Benthic Invertebrate and Water Quality Monitoring Data from the Athabasca River.
OTHER1	
PUBLISHER	Research Management Division, Alberta Environment, Edmonton.
OTHER2	
ANNOTATION	This report presents a detailed statistical analysis including principal components analysis of water quality and benthic invertebrate data from previous studies on the Athabasca River. Benthic invertebrate data were from a 1981 study. The Athabasca River from the Horse River upstream of Fort McMurray to the Tar River confluence was the study area. Six water quality monitoring stations and eight benthic invertebrate stations were included. Water quality data for the period 1976 to 1983 were analyzed. The influence of the Clearwater River and other east bank tributaries as well as nutrient enrichment from the Fort McMurray sewage treatment plant was discerned. There was no evidence of differences due to the Suncor development.
KEY_WATER	ATHABASCA
KEY_GEOG	FORT MCMURRAY, ALBERTA
KEY_PARAM	
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER, BIOTA
KEY_MISC1	RIVER, WATER QUALITY, BENTHOS, SAMPLING
KEY_MISC2	
KEY_MISC3	

AUTHOR	Wallace, R.R. and P.J. McCart.
DATE	1984
DUP_DATE	
TITLE	The Fish and Fisheries of the Athabasca River Basin, Their Status and Environmental Requirements.
OTHER1	Prepared for Planning Division, Alberta Environment.
PUBLISHER	Dominion Ecological Consulting Ltd.
OTHER2	March 31, 1984.
ANNOTATION	"The information presented reviews what is currently known of fish ecology and production of the Athabasca Basin, and includes discussions of fish production, sport and commercial use of fish populations, and alternative opportunities for recreational fishing in the rivers of the Athabasca Basin. Fisheries management objectives for the basin rivers and data gaps in existing knowledge of fish and fisheries are also discussed. In addition, water quality criteria for the protection of fish and aquatic life have been referenced, and, where possible, stream flows which affect fish populations have been included." (as cited in document)
KEY_WATER	ATHABASCA, MCLEOD, PEMBINA, LESSER SLAVE
KEY_GEOG	ALBERTA, ATHABASCA
KEY_PARAM	PHYSICAL PARAMETERS, ORGANICS, NON-METAL ORGANICS, OXYGEN
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	BASELINE, ECOLOGY, FISH, INVENTORY, RIVER, SALMONID, STUDIES, WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Weldwood of Canada Limited.
DATE	n.d.
DUP_DATE	
TITLE	Technical Department Reports, 1972-1992.
OTHER1	Collection of Technical Department Reports from Weldwood of Canada (formerly St. Regis/North Western Pulp and Power Ltd.).
PUBLISHER	Weldwood of Canada Ltd.
OTHER2	File 1600-3.
ANNOTATION	The bleached kraft pulp mill located at Hinton conducted water quality surveys on the Athabasca every year from 1972 to 1992. Since 1976 they have included at least one winter survey. Nutrients were not measured. Dissolved oxygen surveys under ice covered conditions began in 1988. Monitoring increased with more stringent license requirements. In 1991 analyses were extended to include resin and fatty acids, chlorinated phenolics, AOX, sulphide, phosphorus, nitrogen and other measurements.
KEY_WATER	ATHABASCA
KEY_GEOG	HINTON, ALBERTA, ATHABASCA
KEY_PARAM	PHYSICAL PARAMETERS, OXYGEN DEMAND, OXYGEN, ORGANICS, NUTRIENTS
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	WATER QUALITY, WELDWOOD, PULP MILL, EFFLUENT, SAMPLING, MONITORING, RIVER, HINTON, SURVEY
KEY_MISC2	
KEY_MISC3	

APPENDIX B

REFERENCES CITED FROM ANNOTATED BIBLIOGRAPHIES

AUTHOR Akena, A.M. and D.R. Froelich.
DATE 1979.
DUP_DATE
TITLE An Intensive Surface Water Quality Study of the Muskeg River Watershed.
OTHER1
PUBLISHER Pollution Control Division, Alberta Environment and Finance and Administration.
OTHER2 December 1979.

CITATION Alberta Environment Library, 1992.

AUTHOR Alberta Department of Health.
DATE 1968.
DUP_DATE
TITLE Preliminary Compatibility Studies of G.C.O.S. Sand Tailings Pond Water with Athabasca River.
OTHER1
PUBLISHER Environmental Health Services Division, Alberta Dept. of Health, Edmonton, Alberta.
OTHER2 June 1968.

CITATION Alberta Environment Library, 1992.

AUTHOR Alberta Department of Health.
DATE 1970.
DUP_DATE
TITLE Athabasca River Oil Spill June 1970.
OTHER1
PUBLISHER Environmental Health Services Division, Alberta Department of Health, Edmonton, June 1970. 16 pp. + Appendix.
OTHER2

CITATION Bramm, 1983.

AUTHOR Alberta Department of Public Health.
DATE 195-
DUP_DATE
TITLE Summary Report: Athabasca River Pollution Survey.
OTHER1
PUBLISHER Alberta Department of Public Health, Division of Sanitary Engineering, Edmonton, Alberta.
OTHER2

CITATION Alberta Environment Library, 1992.

AUTHOR Alberta Environment.
DATE 1970.
DUP_DATE
TITLE Athabasca River Oil Spill.
OTHER1 Ms. Rept.
PUBLISHER Water Quality Branch, Edmonton.
OTHER2

CITATION Wallace and McCart, 1984.

AUTHOR Alberta Environment.
DATE 1980.
DUP_DATE
TITLE A Bibliography of the Athabasca Oil Sands Fort McMurray, Alberta Area: Socio-Economic and Environmental Studies.
OTHER1 6th Edition.
PUBLISHER Alberta Environment Library, Edmonton.
OTHER2 341 pp.

CITATION Wallace and McCart, 1984.

AUTHOR Alberta Environment.
DATE 1981.
DUP_DATE
TITLE Annual Report: Industrial Effluent Monitoring.
OTHER1
PUBLISHER Pollution Control Division, Water Quality Branch, Alberta Environment.
OTHER2 82 pp.

CITATION Wallace and McCart, 1984.

AUTHOR Alberta Environment.
DATE 1982.
DUP_DATE
TITLE A Bibliography of the Athabasca Oil Sands Fort McMurray, Alberta Area: Socio-Economic and Environmental Studies.
OTHER1 1982 Supplement to the 6th Edition.
PUBLISHER Alberta Environment Library, Edmonton.
OTHER2 236 pp.

CITATION Wallace and McCart, 1984.

AUTHOR Alberta Environment.
DATE 1983.
DUP_DATE
TITLE Athabasca River Basin Active Water Use Projects and Municipal and Industrial Waterworks & Wastewater Information Summary.
OTHER1
PUBLISHER Planning Division, Alberta Environment.
OTHER2 March 1987; 120 pp.

CITATION McGregor and Cary, 1991.

AUTHOR Alberta Environment.
DATE 1988.
DUP_DATE
TITLE Alberta Preliminary Dioxin Results.
OTHER1
PUBLISHER Alberta Environment, News Release No. 119. July 20, 1988.
OTHER2

CITATION Noton, 1989.

AUTHOR	Alberta Government Committee Report.
DATE	1970.
DUP_DATE	
TITLE	Great Canadian Oil Sands Oil Spill to Athabasca River, June 6, 1970.
OTHER1	Report completed Aug. 1970.
PUBLISHER	
OTHER2	
CITATION	Wallace and McCart, 1984.

AUTHOR	Alberta Oil Sands Environmental Research Program.
DATE	1979.
DUP_DATE	
TITLE	Acute Lethality of Mine Depressurization Water to Trout, Perch and Rainbow Trout - Volume I.
OTHER1	
PUBLISHER	
OTHER2	AOSERP Report AF1.1.2.
CITATION	McGregor and Cary, 1991.

AUTHOR Alberta Oil Sands Environmental Research Program.
DATE 1980.
DUP_DATE a.
TITLE Aquatic Biophysical Inventory of Major Tributaries in the AOSERP Study Area, Volume I: Summary Report.
OTHER1
PUBLISHER Alberta Oil Sands Environmental Research Program. WS 3.4.
OTHER2

CITATION McGregor and Cary, 1991.

AUTHOR Alberta Oil Sands Environmental Research Program.
DATE 1980.
DUP_DATE b.
TITLE A Laboratory Study of Long-Term Effects of Mine Depressurization Groundwater on Fish and Invertebrates.
OTHER1
PUBLISHER
OTHER2

CITATION McGregor and Cary, 1991.

AUTHOR	Allan, R.J. and T.A. Jackson.
DATE	1977.
DUP_DATE	
TITLE	Heavy Metal Dynamics in the Athabasca River: Sediment Concentrations Prior to Major Alberta Oil Sands Development.
OTHER1	
PUBLISHER	Hydrology Research Committee. Alberta Oil Sands Environmental Research Program.
OTHER2	33 pp.
CITATION	M.A. Carson & Associates, 1990.

AUTHOR	Anderson, P.D., P. Spear, S. D'Apollinia, S. Perry, J. deLuca and J. Dick.
DATE	1979.
DUP_DATE	
TITLE	The Multiple Toxicity of Vanadium, Nickel and Phenol to fish.
OTHER1	
PUBLISHER	
OTHER2	AOSERP Report 79. 109 pp.
CITATION	Hamilton et al., 1987.

AUTHOR Anonymous.
DATE 1972.
DUP_DATE
TITLE A Collection of Information on Water Quality in the Peace-Athabasca Delta.
OTHER1
PUBLISHER Alberta Environment Library.
OTHER2

CITATION Alberta Environment Library, 1992.

AUTHOR Aquatic Environments Ltd.
DATE 1981.
DUP_DATE
TITLE Chemical & Biological Monitoring of Muskeg Drainage at the Alsands Site: Vol. I Muskeg River.
OTHER1
PUBLISHER Alberta Environment/Alsands Energy Ltd.
OTHER2

CITATION McGregor and Cary, 1991.

AUTHOR	Ashmore, P.E., T.R. Yuzyk, and R. Herrington.
DATE	1988.
DUP_DATE	
TITLE	Bed Material Sampling in Sand-Bed Streams.
OTHER1	
PUBLISHER	Inland Waters Directorate. Ottawa.
OTHER2	Report IWD-HQ-WRB-SS-88-4.
CITATION	M.A. Carson & Associates, 1991b.

AUTHOR	Beebe, T.
DATE	1979.
DUP_DATE	
TITLE	Great Canadian Oil Sands, Fort McMurray, Industrial Effluent Monitoring Summary Report 1976-1978.
OTHER1	
PUBLISHER	Pollution Control Division, Alberta Environment.
OTHER2	72 pp.
CITATION	Alberta Environment Library, 1992.

AUTHOR	Beltaos, S. and R. Gerard.
DATE	1975.
DUP_DATE	
TITLE	Blackfly Abatement Program: Evaluation of Insecticide Mixing in the Athabasca River Downstream of Athabasca.
OTHER1	
PUBLISHER	Interim Rept., River Eng. Div., Alberta Res. Council.
OTHER2	6 pp.
CITATION	Wallace and McCart, 1984.

AUTHOR	Bergstrom, G.
DATE	1989.
DUP_DATE	
TITLE	The Influence of Timber Harvesting on Alberta's Northern Rivers.
OTHER1	In: Bradley, C., A.A. Einseidel Jr., T. Pyrch and K. Van Tighem, (ed.). Flowing to the Future. Proceedings of the Alberta's Rivers Conference. May 11-13, 1989.
PUBLISHER	Faculty of Extension, University of Alberta.
OTHER2	
CITATION	D.A. Westworth & Associates Ltd., 1992.

AUTHOR Biddinger, G.R. and S.P. Gloss.
DATE 1984.
DUP_DATE
TITLE The Importance of Trophic Transfer in the Bioaccumulation of Chemical Contaminants in Aquatic Ecosystems.
OTHER1
PUBLISHER Residue Reviews 90:103-145.
OTHER2

CITATION Hamilton et al., 1987.

AUTHOR Bidgood, B.F.
DATE 1966.
DUP_DATE
TITLE Water Quality Study - Athabasca River.
OTHER1 Alberta.
PUBLISHER
OTHER2

CITATION Alberta Environment Library, 1992.

AUTHOR Bidgood, B.F.
DATE 1967.
DUP_DATE
TITLE Chlorinated Organic Insecticides in Fish.
OTHER1 Unpub. Ms. Rept., Alberta Fish and Wildlife Division, Edmonton.
PUBLISHER
OTHER2

CITATION Wallace and McCart, 1984.

AUTHOR Birkholz, D.A., S. Swanson, J.W. Owens.
DATE 1992.
DUP_DATE
TITLE PCDD, PCDF and EOCL Bioaccumulation in a Northern Canadian River System.
OTHER1 Abstract Submitted to Dioxin '92 Conference, August 24-28, 1992. Tampere, Finland.
PUBLISHER
OTHER2

CITATION Anonymous, 1992b.

AUTHOR Bond, W.A. and K. Machniak.
DATE 1979.
DUP_DATE
TITLE An Intensive Study of the Fish Fauna of the Steepbank Muskeg River Watershed of Northeastern Alberta.
OTHER1
PUBLISHER Alberta Environment and Environment Canada, Edmonton, Alberta.
OTHER2 Alberta Oil Sands Environmental Research Program Report 76, Project AF 4.5.1.

CITATION Holmberg, 1992.

AUTHOR Brytus, G.
DATE 1982.
DUP_DATE
TITLE Athabasca River Monitoring Program - 1981.
OTHER1
PUBLISHER Pollution Control Division, Alberta Environment, Edmonton, Alberta.
OTHER2

CITATION Holmberg, 1992.

AUTHOR Butcher, G.A.
DATE 1987.
DUP_DATE
TITLE Peace River Area: Peace River Mainstem Water Quality Assessment and Objectives.
OTHER1
PUBLISHER Water Quality Unit, Resource Quality Section, Water Management Branch, Ministry of Environment and Parks, Victoria, B.C.
OTHER2

CITATION Alberta Environment Library, 1992.

AUTHOR Cherwinsky, C. and D. Murray.
DATE 1986.
DUP_DATE
TITLE Preliminary Investigation of Trace Contaminants in Pulp and Paper Mill Effluents.
OTHER1
PUBLISHER Ontario Ministry of the Environment.
OTHER2 135 pp.

CITATION Noton, Anderson, Reynoldson and Kostler, 1989.

AUTHOR	Clark, K.A.
DATE	1959.
DUP_DATE	
TITLE	Monthly Analyses of Athabasca River Water Sampled at and Near Fort McMurray, Alberta.
OTHER1	
PUBLISHER	Research Council of Alberta, Edmonton, Alberta.
OTHER2	2 pp.
CITATION	Alberta Environment Library, 1992.

AUTHOR	Connell, D.W. and G.J. Miller.
DATE	1981.
DUP_DATE	
TITLE	Petroleum Hydrocarbons in Aquatic Ecosystems: Behaviour and Effects of Sublethal Concentrations.
OTHER1	In: Critical Reviews on Environmental Control. Issues I and II. C.P. Straub (ed).
PUBLISHER	CRC Press Inc., Boca Raton, Florida. Pp. 37-150.
OTHER2	
CITATION	Hamilton et al., 1987.

AUTHOR Costerton, J.W and G.G. Geesey.
DATE 1979.
DUP_DATE
TITLE Microbial Populations in the Athabasca River.
OTHER1
PUBLISHER Department of Geology, University of Calgary.
OTHER2 AOSERP Report. 66 pp.

CITATION Alberta Environment Library, 1992.

AUTHOR Cross, S.F. and P.G. Nix.
DATE 1986.
DUP_DATE
TITLE Survey of Benthos and Water/Sediment Quality in the Peace River near Taylor, B.C.
OTHER1
PUBLISHER EVS Consultants Ltd., Sidney, B.C.
OTHER2 January 1986. 73 pp.

CITATION Alberta Environment Library, 1992.

AUTHOR	Crowther, R.A., N.J. Olyslager, J.E. Green and R.R. Wallace.
DATE	1990.
DUP_DATE	
TITLE	Examination for the Presence of Contaminants in the Athabasca River Delta: An Analysis of Sediments from Perched Lake Basins.
OTHER1	Prepared for the Athabasca Chipewyan Band, Fort Chipewyan.
PUBLISHER	UMA Engineering Ltd.
OTHER2	
CITATION	Jaakko, 1990.

AUTHOR	Dabbs/R. Webb/Aquatic/Monenco.
DATE	1984.
DUP_DATE	
TITLE	Biophysical Impact Assessment for the New Facilities at the Syncrude Canada Ltd. Mildred Lake Plant.
OTHER1	
PUBLISHER	
OTHER2	
CITATION	McGregor and Cary, 1991.

AUTHOR Department of the Environment.
DATE 1972.
DUP_DATE
TITLE Position Paper on Water Quality Considerations for the Peace-Athabasca Delta after July 1, 1972.
OTHER1 Prepared for the Director, Peace-Athabasca Delta Project.
PUBLISHER Water Quality Branch, Western Region, Department of the Environment.
OTHER2 1972. 5 pp.

CITATION Bramm, 1983.

AUTHOR Dickson, T.A. and P.J. McCart.
DATE 1981.
DUP_DATE
TITLE Final Report on the Fish Populations in the Vicinity of the Proposed Pipeline Sites on the Pembina River and Dismal Creek.
OTHER1 Prepared for Hudson's Bay Oil and Gas Co. Ltd.
PUBLISHER Aquatic Environments Ltd.
OTHER2 August 1981. 48 pp.

CITATION Wallace and McCart, 1984.

AUTHOR	de March, G.E.
DATE	1975.
DUP_DATE	
TITLE	Short-Term Effects of a Methoxychlor Treatment on the Zoobenthos of the Athabasca River, Alberta.
OTHER1	Ms. Rept.
PUBLISHER	Freshwater Institute, Winnipeg.
OTHER2	18 pp.
CITATION	Wallace and McCart, 1984.

AUTHOR Environment Canada.
DATE 1971.
DUP_DATE
TITLE Water Quality Data Sheets for Stations in the Peace-Athabasca Delta.
OTHER1
PUBLISHER Inland Waters Branch, Environment Canada, Ottawa.
OTHER2 325 pp.

CITATION Alberta Environment, 1992.

AUTHOR Environment Canada.
DATE 1972.
DUP_DATE
TITLE Position Paper on Water Quality Considerations for Peace-Athabasca Delta after July 1, 1972.
OTHER1
PUBLISHER Western Region, Water Quality Branch, Environment Canada.
OTHER2 5 pp.

CITATION Alberta Environment Library, 1992.

AUTHOR	Exner, K.
DATE	1976.
DUP_DATE	
TITLE	Biological Effects of an Oil Spill on a Small Stream.
OTHER1	Unpub. Ms. Rept., Alberta Environment, Edmonton.
PUBLISHER	
OTHER2	
CITATION	Wallace and McCart, 1984.

AUTHOR	Flannagan, J.F.
DATE	1976.
DUP_DATE	
TITLE	Preliminary Report on Studies to Determine the Effect of Methoxychlor Treatment (1975) on the Aquatic Invertebrates of the Athabasca River, Alberta.
OTHER1	Ms. Rept.
PUBLISHER	Freshwater Institute, Winnipeg.
OTHER2	16 pp.
CITATION	Wallace and McCart, 1984.

AUTHOR	Flannagan, J.F., B.E. Townsend, B.E. de March, M. Friesen and S.L. Leonhard.
DATE	1978.
DUP_DATE	
TITLE	The Effects of an Experimental Injection of Methoxychlor on the Drift of Aquatic Invertebrates and Its Accumulation in Caged and Wild Invertebrates.
OTHER1	Ms. Rept.
PUBLISHER	Freshwater Institute, Winnipeg.
OTHER2	32 pp.
CITATION	Wallace and McCart, 1984.

AUTHOR	Fox, M.E.
DATE	1977.
DUP_DATE	
TITLE	Persistence of Dissolved Organic Compounds in Kraft Pulp and Paper Mill Effluent Plumes.
OTHER1	
PUBLISHER	J. Fish. Res. Board Can. 34: 798-804.
OTHER2	
CITATION	Taylor, MacDonald and Hamilton, 1990.

AUTHOR	Graves, F.F., P.T.P. Tsui, and P.J. McCart.
DATE	1975.
DUP_DATE	
TITLE	Impact of Luscar-Sterco Coalmine Development on Aquatic Environments.
OTHER1	Prepared for Luscar-Sterco Coalmine.
PUBLISHER	Aquatic Environments Ltd.
OTHER2	November 1975. 137 pp.
CITATION	Wallace and McCart, 1984.

AUTHOR	Griffiths, W.E.
DATE	1973.
DUP_DATE	
TITLE	Preliminary Fisheries Survey of the Fort McMurray Tar Sands Area.
OTHER1	
PUBLISHER	Fish and Wildlife Division, Alberta Department of Lands and Forests.
OTHER2	622 pp.
CITATION	Wallace and McCart, 1984.

AUTHOR Hartman, W.A. and D.B. Martin.
DATE 1984.
DUP_DATE
TITLE Effect of Suspended Bentonite Clay on the Acute Toxicity of Glyphosate to Daphnia pulex and Lemna minor.
OTHER1
PUBLISHER Bull. Environ. Contam. Toxicol. 33:355-361.
OTHER2

CITATION M.A. Carson & Associates, 1991b.

AUTHOR Hickman, M., S.E.D. Charlton and C.G. Jenkerson.
DATE 1979.
DUP_DATE
TITLE Interim Report on a Comparative Study of Benthic Algal Primary Productivity in the AOSERP Study Area.
OTHER1 Prepared for Alberta Oil Sands Environmental Research Program.
PUBLISHER Dept. of Botany, University of Alberta.
OTHER2 AOSERP Report 75. 107 pp.

CITATION Wallace and McCart, 1984.

AUTHOR Hrudey, S.E.
DATE 1975.
DUP_DATE
TITLE Characterization of Wastewaters from the Great Canadian Oil Sands Bitumen Extraction and Upgrading Plant.
OTHER1
PUBLISHER Water Pollution Control Section, Environmental Protection Service, Environment Canada.
OTHER2 Report No. EPS 5-NW-WP-75-6. 24 pp.

CITATION Hamilton et al., 1987.

AUTHOR Hutchins, F.E.
DATE 1979.
DUP_DATE
TITLE The Toxicity of Pulp and Paper Mill Effluent: A Literature Review.
OTHER1
PUBLISHER Environmental Research Laboratory, Corvallis, Oregon, U.S.A.
OTHER2 EPA-600/3-79-013.

CITATION Davis et al., 1988.

AUTHOR HydroQual Consultants Inc.
DATE 1986.
DUP_DATE
TITLE Aquatic Fate of Fish Tainting Compounds in the Athabasca River.
OTHER1
PUBLISHER Planning Division, Alberta Environment.
OTHER2

CITATION McGregor and Cary, 1991.

AUTHOR IEC Beak Consultants Ltd.
DATE 1985.
DUP_DATE
TITLE Peace River Basin Water Quality Overview.
OTHER1
PUBLISHER IEC Beak Consultants Ltd.
OTHER2

CITATION McGregor and Cary, 1991.

AUTHOR	ISL Infrastructure Systems Inc. and Dominion Ecological Consulting Ltd.
DATE	1989.
DUP_DATE	
TITLE	Athabasca River Water Quality Review for the City of Fort McMurray.
OTHER1	Report Prepared for the City of Fort McMurray, Alberta.
PUBLISHER	
OTHER2	
CITATION	Jaakko, 1990.

AUTHOR	Intercontinental Engineering of Alberta.
DATE	1973.
DUP_DATE	
TITLE	An Environmental Study of the Athabasca Tar Sands.
OTHER1	Prepared for Alberta Department of the Environment, Edmonton.
PUBLISHER	IEA.
OTHER2	112 pp.
CITATION	M.A. Carson & Associates, 1990.

AUTHOR International Environmental Consultants Ltd.
DATE 1981.
DUP_DATE
TITLE Athabasca River Modelling Studies (Phase I) Fort McMurray-Embarras.
OTHER1
PUBLISHER Alberta Oil Sands Environmental Consultants Ltd.
OTHER2 May 1981; 100 pp.

CITATION McGregor and Cary, 1991.

AUTHOR Jantzie, T.D.
DATE 1977.
DUP_DATE
TITLE A Synopsis of Information Relating to Aquatic Ecosystems Toxicology Within the Alberta Oil Sands Area.
OTHER1
PUBLISHER Renewable Resources Consulting Services Ltd., Edmonton.
OTHER2 AOSERP. 70 pp.

CITATION Alberta Environment Library, 1992.

AUTHOR	Jardine, C.B. and S.E. Hrudey
DATE	1988.
DUP_DATE	
TITLE	Threshold Detection Values of Potential Fish Tainting Substances from Oil Sands Wastewaters.
OTHER1	Prepared for Research Management Division, Alberta Environment.
PUBLISHER	
OTHER2	
CITATION	

AUTHOR	Johnson, C.I., R.D. Smillie and L.R. Noton.
DATE	1992.
DUP_DATE	
TITLE	Chlorinated Phenols, Guaiacols, Catechols and Veratroles in the Athabasca River.
OTHER1	Presented to 75th Canadian Chemical Conference.
PUBLISHER	Research and Methods Development Branch, Albertal Environmental Centre and Environmental Quality Monitoring Branch, Alberta Environment.
OTHER2	
CITATION	Chambers, 1993.

AUTHOR Jones, M.L., G.J. Mann and P.J. McCart.
DATE 1978.
DUP_DATE
TITLE Fall Fisheries Investigations in the Athabasca and Clearwater Rivers Upstream of Fort McMurray. Volume I.
OTHER1 Prepared for the Alberta Oil Sands Environmental Research Program.
PUBLISHER Aquatic Environments Ltd., Calgary, Alberta.
OTHER2 AOSERP Report 37. 71 pp.

CITATION Holmberg, 1992.

AUTHOR Koning, C.W. and S.E. Hrudey.
DATE 1988.
DUP_DATE
TITLE Sensory and Chemical Analyses of Fish Tainting by Exposure to Oil Sands Wastewaters.
OTHER1 Prepared for Research Management Division, Alberta Environment.
PUBLISHER
OTHER2 RMD Report 85-12B.

CITATION

AUTHOR Kristensen, J., B.S. Ott and A.D. Sekerat.
DATE 1976.
DUP_DATE
TITLE Walleye and Goldeye Fisheries Investigations in the Peace-Athabasca Delta - 1975.
OTHER1
PUBLISHER
OTHER2 AOSERP Report 2. 103 pp.

CITATION Hamilton et al., 1987.

AUTHOR Kuivasniemi, K., U. Eloranta, and Halttunen-Keyrilainen.
DATE 1986.
DUP_DATE
TITLE Ageing of Bleached Kraft Mill Effluent Studied by Degradation of Chlorinated Phenolic Compounds and Selenastrum Algal Assays.
OTHER1
PUBLISHER Environ. Poll. 41:247-262.
OTHER2

CITATION (Cited in Davis et al., 1988).

AUTHOR Laycock, A.H.
DATE 1974.
DUP_DATE
TITLE Water Problems in Alberta Oilsands Development.
OTHER1
PUBLISHER American Water Resources Assoc., Proc. No. 18, 184-200.
OTHER2

CITATION M.A. Carson & Associates, 1990.

AUTHOR Lock, M.A. and R.R. Wallace.
DATE 1978.
DUP_DATE
TITLE Interim Report on Ecological Studies on the Lower Trophic Levels of Muskeg Rivers Within the AOSERP Study Area.
OTHER1 Prepared for Alberta Oil Sands Environmental Research Program.
PUBLISHER Fisheries and Marine Service.
OTHER2 AOSERP Project AF 2.0.2. 101 pp.

CITATION Wallace and McCart, 1984.

AUTHOR	Lockhart, W.L., D.A. Metner and J. Solomon.
DATE	1977.
DUP_DATE	
TITLE	Methoxychlor Residue Studies in Caged and Wild Fish from the Athabasca River, Alberta, Following a Single Application of a Blackfly Larvicide.
OTHER1	
PUBLISHER	J. Fish. Res. Board Canada 34:626-632.
OTHER2	
CITATION	Wallace and McCart, 1984.

AUTHOR	Loeppky, K.D. and M.O. Spitzer.
DATE	1977.
DUP_DATE	
TITLE	Alberta Oil Sands Region Stream Gauging Data Compilation.
OTHER1	WSC Preliminary Report.
PUBLISHER	
OTHER2	
CITATION	M.A. Carson & Associates, 1990.

AUTHOR Martinsen, K., A. Kringstad and G.E. Carlberg.
DATE 1988.
DUP_DATE
TITLE Methods for Determination of Sum Parameters and Characterization of Organochlorine Compounds in Spent Bleach Liquors from Pulp Mills and Water, Sediment, and Biological Samples from Receiving Waters.
OTHER1
PUBLISHER Water Sci. Technol. 20(2):13-24.
OTHER2

CITATION Noton, 1990b.

AUTHOR Mayhood, D.W., et al.
DATE 1981.
DUP_DATE (Draft).
TITLE Chemical and Biological Monitoring of Muskeg Drainage at the Alsands Project Site (Draft).
OTHER1 Prepared for Alberta Environment.
PUBLISHER Aquatic Environments Ltd, Calgary, Alberta.
OTHER2

CITATION Alberta Environment Library, 1992.

AUTHOR Munkittrick, K.R. and D.G. Dixon.
DATE 1989.
DUP_DATE
TITLE Use of White Sucker (Catostomus commersoni) Populations to Assess the Health of Aquatic Ecosystems Exposed to Low-Level Contaminant Stress.
OTHER1
PUBLISHER Can. J. Fish. Aquat. Sci. 46:1455-1462.
OTHER2

CITATION EVS Consultants Ltd., 1990.

AUTHOR Nix, P.G.
DATE 1979.
DUP_DATE
TITLE A Preliminary Study of Chemical and Microbial Characteristics of the Athabasca River in the Athabasca Oil Sands Area of Northeastern Alberta.
OTHER1
PUBLISHER Chemical and Geological Laboratories Ltd., Edmonton, Alberta.
OTHER2 135 pp.

CITATION Alberta Environment Library, 1992.

AUTHOR	Nix, P.G., D.W.S. Westlake, R.T. Coutts and F.M. Pasutto.
DATE	1981.
DUP_DATE	
TITLE	The Metabolism of Selected Organic Compounds by Micro-organisms in the Athabasca River.
OTHER1	Prepared for Alberta Oil Sands Environmental Research Program.
PUBLISHER	Chemical and Geological Laboratories Ltd., University of Alberta Department of Microbiology and Xenotox Services Ltd.
OTHER2	AOSERP Report 121. 97 pp.
CITATION	Hamilton et al., 1987.

AUTHOR	Nix, P.G., J.W. Costerton, R. Ventullo and R.T. Coutts.
DATE	1979.
DUP_DATE	
TITLE	A Preliminary Study of Chemical and Microbial Characteristics of the Athabasca River in the Athabasca Oil Sands Area of Northeastern Alberta.
OTHER1	Prepared for Alberta Oil Sands Environmental Research Program.
PUBLISHER	Chemical and Geological Laboratories Ltd., Microbios Ltd. and Xenotox Services Ltd.
OTHER2	AOSERP Report 54. 135 pp.
CITATION	Hamilton et al., 1987.

AUTHOR	Peace River Planning Commission.
DATE	1977.
DUP_DATE	
TITLE	Water Quality of Rivers in the Peace River Region of Alberta.
OTHER1	
PUBLISHER	Peace River Regional Planning Commission, Grande Prairie, Alberta.
OTHER2	Information Paper No. 9. 20 pp.
CITATION	Alberta Environment Library, 1992.

AUTHOR Reeder, S.W.
DATE 1972.
DUP_DATE
TITLE Interim Water Quality Report: Peace-Athabasca Delta Study, Winter Season 1971.
OTHER1
PUBLISHER Water Quality Division, Inland Waters Branch, Department of the Environment.
OTHER2 12 pp + Appendices.

CITATION Bramm, 1983.

AUTHOR Seidner, R.T.
DATE 1980.
DUP_DATE
TITLE Regional Water Quality of the AOSERP Study Area. Volume II: Discussion of 1976 and 1977 Data.
OTHER1 Prepared for the Alberta Oil Sands Environmental Research Program.
PUBLISHER Alberta Environment.
OTHER2 AOSERP Project HY 2.8.1. 245 pp.

CITATION Noton, 1989.

AUTHOR Smith, A.L.
DATE 1974.
DUP_DATE
TITLE The Effects of Effluents from the Canadian Petrochemical Industry on Aquatic Organisms.
OTHER1
PUBLISHER Fisheries and Marine Service, Environment Canada.
OTHER2 Technical Report No. 472. 68 pp.

CITATION Hamilton et al., 1987.

AUTHOR Smith, S.B.
DATE 1981.
DUP_DATE
TITLE Alberta Oil Sands Environmental Research Program 1975-1980: Summary Report.
OTHER1 Prepared for Alberta Oil Sands Environmental Research Program by S.B. Smith Environmental Consultants Limited.
PUBLISHER Alberta Oil Sands Environmental Research Program.
OTHER2 AOSERP Report 188. 170 pp.

CITATION McGregor and Cary, 1991.

AUTHOR	Strosher, M.T. and E. Peake.
DATE	1976.
DUP_DATE	
TITLE	The Evaluation of Waste Waters from an Oil Sand Extraction Plant.
OTHER1	
PUBLISHER	Hydrology Research Committee, Alberta Oil Sands Environmental Research Program.
OTHER2	Project HY 3.1, 103 pp.
CITATION	M.A. Carson & Associates, 1990.

AUTHOR	Strosher, M.T. and E. Peake.
DATE	1978.
DUP_DATE	
TITLE	Characterization of Organic Constituents in Waters and Wastewaters of the Athabasca Oil Sands Mining Area.
OTHER1	
PUBLISHER	Alberta Oil Sands Environmental Research Program. Prep. by the University of Calgary, Environmental Sciences Centre.
OTHER2	AOSERP Report 20. 71 pp.
CITATION	Hamilton, Thompson and Corkum, 1985.

AUTHOR	Strosher, M.T. and E. Peake.
DATE	1979.
DUP_DATE	
TITLE	Baseline States of Organic Constituents in the Athabasca River System Upstream of Fort McMurray.
OTHER1	Prepared for Alberta Oil Sands Environmental Research Program.
PUBLISHER	University of Calgary, Kananaskis Cnetre for Environmental Sciences.
OTHER2	AOSERP Report 53. 71 pp.
CITATION	Hamilton et al., 1987.

AUTHOR Syncrude Canada Ltd.
DATE
DUP_DATE (Unknown).
TITLE Water Quality Monitoring - Athabasca River, 1968-1970.
OTHER1
PUBLISHER Syncrude Canada Ltd., Edmonton, Alberta.
OTHER2 7 pp.

CITATION Alberta Environment Library, 1992.

AUTHOR Syncrude Canada Ltd.
DATE 1973.
DUP_DATE a.
TITLE Syncrude Canada Ltd. - Environmental Impact Assessment: Vol. III Baseline Information.
OTHER1
PUBLISHER Syncrude Canada Ltd.
OTHER2

CITATION McGregor and Cary, 1991.

AUTHOR Syncrude Canada Ltd.
DATE 1973.
DUP_DATE b.
TITLE Syncrude Canada Ltd. - Environmental Impact Assessment: Vol. IV Supporting Studies.
OTHER1
PUBLISHER Syncrude Canada Ltd.
OTHER2

CITATION McGregor and Cary, 1991.

AUTHOR Wilhm, J.L. and T. Dorris.
DATE 1966.
DUP_DATE
TITLE Species Diversity of Benthic Macroinvertebrates in a Stream Receiving Domestic and Oil Refiner Effluents.
OTHER1
PUBLISHER American Midland Naturalist. 76:427-449.
OTHER2

CITATION Terrestrial and Aquatic Environmental Managers Ltd., 1992.

AUTHOR Wright, D.G.
DATE 1975.
DUP_DATE
TITLE The Control of Blackflies in the Athabasca River, Alberta.
OTHER1 Ms. Rept.
PUBLISHER Freshwater Institute, Winnipeg.
OTHER2 21 pp.

CITATION Wallace and McCart, 1984.

AUTHOR Yaremko, E.K. and R.B. Murry.
DATE 1979.
DUP_DATE
TITLE Evaluation of the Baseline Hydrometric and Water Quality Networks in the AOSERP Study Area.
OTHER1
PUBLISHER Northwest Hydraulic Consultants Ltd. and Chemical and Geological Laboratories Ltd., Edmonton.
OTHER2 June 1979. 213 pp.

CITATION Alberta Environment Library, 1992.

APPENDIX C

ANNOTATED BIBLIOGRAPHY OF MAJOR DATABASES

AUTHOR	Alberta Environmental Protection.
DATE	n.d.
DUP_DATE	(inprogrs)
TITLE	NAQUADAT.
OTHER1	
PUBLISHER	Environmental Assessment Division, Monitoring Branch, Alberta Environment.
OTHER2	
ANNOTATION	Alberta Environment's instream water quality monitoring data. Includes synoptic surveys, long-term and medium-term network stations.
KEY_WATER	ATHABASCA, WAPITI, LESSER SLAVE, SLAVE, PEACE, BEAVER, MCLEOD, CLEARWATER, MUSKET, SMOKY, BOW
KEY_GEOG	ALBERTA
KEY_PARAM	METALS, NON-METAL INORGANICS, ORGANICS, OXYGEN, OXYGEN DEMAND, PHYSICAL PARAMETERS, TOXIC, NUTRIENTS
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	WATER
KEY_MISC1	BASIN, DATABASE, LAKE, NAQUADAT, NUTRIENT, RIVER, SAMPLING, SURVEY, WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Alberta Environmental Protection.
DATE	n.d.
DUP_DATE	(inprogrs)
TITLE	Municipal Water and Wastewater Database.
OTHER1	
PUBLISHER	Standards and Approvals Division, Water Quality Branch, Alberta Environment.
OTHER2	
ANNOTATION	Database of municipal untreated and treated drinking water and untreated and treated wastewater. Some of the database is in NAQUADAT software and some in dBASE and Lotus.
KEY_WATER	ATHABASCA, WAPITI, LESSER SLAVE, MCLEOD, PEACE, BEAVER, CLEARWATER, PEMBINA, SMOKY, MUSKET, BOW
KEY_GEOG	ALBERTA
KEY_PARAM	METALS, NON-METAL INORGANICS, ORGANICS, OXYGEN, OXYGEN DEMAND, PHYSICAL PARAMETERS, TOXIC, NUTRIENTS
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	BACTERIA
KEY_MEDIA	EFFLUENT, WATER
KEY_MISC1	DATABASE, EFFLUENT, HUMAN HEALTH, MONITORING, NAQUADAT, NUTRIENT, SEWAGE TREATMENT, WATER QUALITY
KEY_MISC2	WATER USE
KEY_MISC3	

AUTHOR	Alberta Environmental Protection.
DATE	n.d.
DUP_DATE	(inprogrs)
TITLE	Water Quality Industrial Discharge Database.
OTHER1	
PUBLISHER	Standards and Approvals Division, Water Quality Branch, Alberta Environment.
OTHER2	
ANNOTATION	A database in "dBASE IV" format of effluent monitoring data for industries which discharge effluents into Alberta waters.
KEY_WATER	ATHABASCA, HINTON, LESSER SLAVE, MCLEOD, NORTH SASKATCHEWAN, PEACE, PEMBINA, SLAVE, SMOKY, WAPITI
KEY_GEOG	ALBERTA
KEY_PARAM	METALS, NON-METAL INORGANICS, ORGANICS, OXYGEN, OXYGEN DEMAND, PHYSICAL PARAMETERS, TOXIC
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	EFFLUENT
KEY_MISC1	ALBERTA-PACIFIC, ANC, DAISHOWA, DATABASE, EFFLUENT, HINTON, INDUSTRY, MILLAR WESTERN, MONITORING
KEY_MISC2	MINING, NUTRIENT, OIL, PROCTER & GAMBLE, PULP MILL, RESOURCES, RIVER, SUNCOR, WELDWOOD, SYNCRUDE
KEY_MISC3	SLAVE LAKE

AUTHOR	Environment Canada.
DATE	n.d.
DUP_DATE	(inprogrs)
TITLE	Environmental Science and Evaluation Directorate, Environment Canada.
OTHER1	
PUBLISHER	
OTHER2	
ANNOTATION	This database includes historical water quality data on about 80 to 100 sample sites in the Peace, Athabasca and Slave river systems. Currently, there are three active sites in these systems. The database is 99% water quality. There is some recent data on organics in sediment and organochlorines in fish muscle and liver.
KEY_WATER	ATHABASCA, PEACE, SLAVE
KEY_GEOG	ALBERTA
KEY_PARAM	METALS, NON-METAL INORGANICS, ORGANICS, OXYGEN, OXYGEN DEMAND, PHYSICAL PARAMATERS, TOXIC, NUTRIENTS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	BIOTA, SEDIMENT, WATER
KEY_MISC1	DATABASE, FISH, NAQUADAT, NUTRIENT, ORGANOCHLORINE, RIVER, SURVEY, WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Department of Indian and Northern Affairs.
DATE	n.d.
DUP_DATE	(inprogrs)
TITLE	Slave River Project.
OTHER1	
PUBLISHER	Water Resources Division, Government of Canada.
OTHER2	
ANNOTATION	This is not a formal database. It contains data on fish, sediment and water from the Slave River in a series of Lotus files. Contact person:

John Witteman
Regional Manager, Water Resources Division
Department of Indian and Northern Affairs
P.O. Box 1500
Yellowknife, NWT X1A 2R3
Telephone: (403) 920-8240
Facsimile: (403) 873-9318

KEY_WATER	SLAVE
KEY_GEOG	NORTHWEST TERRITORIES
KEY_PARAM	METALS, NON-METAL INORGANICS, ORGANICS, OXYGEN, OXYGEN DEMAND, PHYSICAL PARAMETERS, TOXIC, NUTRIENTS
KEY_ANIMAL	VERTEBRATE
KEY_PLANT	
KEY_MCROBE	
KEY_MEDIA	SEDIMENT, WATER
KEY_MISC1	FISH, MONITORING, NUTRIENT, ORGANOCHLORINE, RIVER, WATER QUALITY
KEY_MISC2	
KEY_MISC3	

AUTHOR	Northern River Basins Study.
DATE	n.d.
DUP_DATE	
TITLE	NORTHDAT.
OTHER1	
PUBLISHER	Prepared by N. McCubbin Consultants Inc.
OTHER2	March 1993
ANNOTATION	An effluent database and management system which will extract user-specified data on pulp mill effluents from the industrial wastewater database. It will generate one dBASE III and one Lotus file for each set of specified data.
KEY_WATER	ATHABASCA, HINTON, LESSER SLAVE, MCKAY, MACKENZIE, PEACE, SMOKY, WAPITI
KEY_GEOG	ALBERTA
KEY_PARAM	METALS, NON-METAL INORGANICS, ORGANICS, OXYGEN, OXYGEN DEMAND, PHYSICAL PARAMETERS, TOXIC, NUTRIENT
KEY_ANIMAL	INVERTEBRATE
KEY_PLANT	
KEY_MCROBE	BACTERIA
KEY_MEDIA	EFFLUENT
KEY_MISC1	ANC, DAISHOWA, CONTAMINANT, DATABASE, EFFLUENT, HINTON, MILLAR WESTERN, MONITORING, NUTRIENT, RIVER
KEY_MISC2	ORGANOCHLORINE, PROCTER & GAMBLE, PULP MILL, WELDWOOD
KEY_MISC3	

AUTHOR	Northern River Basins Study.
DATE	n.d.
DUP_DATE	(inprogrs)
TITLE	Effluent Characteristics of Municipal and Non-Pulp Mill Effluents Discharging into the Athabasca, Peace and Slave Rivers.
OTHER1	Project 2112-B1 - Northern River Basins Study.
PUBLISHER	Prepared by SENTAR Consultants Ltd.
OTHER2	
ANNOTATION	A geo-referenced dBASE IV database of all municipal and non-pulp mill effluents which discharge into the Athabasca, Peace and Slave rivers and their tributaries.
KEY_WATER	ATHABASCA, WAPITI, LESSER SLAVE, SLAVE, PEACE, BEAVER, MCLEOD, CLEARWATER, PEMBINA, SMOKY, MUSKEG
KEY_GEOG	ALBERTA
KEY_PARAM	METALS, NON-METAL INORGANICS, ORGANICS, OXYGEN, OXYGEN DEMAND, PHYSICAL PARAMETERS, TOXIC
KEY_ANIMAL	
KEY_PLANT	
KEY_MCROBE	BACTERIA
KEY_MEDIA	EFFLUENT
KEY_MISC1	CONTAMINANT, DATABASE, EFFLUENT, INDUSTRY, MINING, MONITORING, NUTRIENT, RIVER, SAMPLING, SUNCOR
KEY_MISC2	SEWAGE TREATMENT, WATER USE, SYNCRUDE
KEY_MISC3	

APPENDIX D

TERMS OF REFERENCE

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NORTHERN RIVER BASINS STUDY

TERMS OF REFERENCE

Project 2112-B1: Effluent Characterization, Contaminants in Aquatic Ecosystems and Ecotoxicity of Pulp Mill Effluents

I. Introduction

These Terms of Reference have been developed in support of three projects, which to a certain extent, deal with the ecotoxicity of liquid contaminants released into the aquatic environment by municipalities and industries or that already exist in the ambient aquatic environment. All of the projects will involve compiling and synthesizing existing information on contaminants and their ecotoxicological effects. This background information will be vital to the development of a comprehensive ecotoxicity strategy and aquatic ecosystem risk assessment for the Northern River Basins Study.

Proposals will be judged based on the following criteria:

1. the expertise assigned to the project;

2. the work that can be completed on the project before March 31st, 1993;

3. total cost; and,

4. when the entire project will be completed.

II. Effluent Characterization - Municipal and Non-Pulp Mill Industry Sources

1. Objective

The purposes of this project include the following:

1) to identify the location, treatment technology, types of wastes (ie., liquid, solid, gas) and waste disposal methods of all licensed effluent dischargers in the Peace, Athabasca and Slave river basins: and,

2) to compile and synthesize existing information from government and industry sources on the nature of liquid effluents (ie., nutrients, pathogens, contaminants, toxic compounds, compounds that cause taste and odour problems in fish and water, etc.) from municipal and non-pulp mill industries that are being discharged into the Peace, Athabasca and Slave rivers and their major tributaries.

2. Requirements

1) Identification of Effluent Sources

Compile existing information from government and industry sources pertaining to the location, treatment technology, types of wastes (ie., liquid, solid, gas) and waste disposal methods of all licensed effluent dischargers in the Alberta and Northwest Territories portions of the Peace, Athabasca and Slave river basins. This information is to be compiled in a geo-referenced (to facilitate GIS utilization of the data), electronic database (dBase IV format).

2) Non-Pulp Mill Industry and Municipal Effluent Characterization

a) Based on 1, above, identify those licensed dischargers that release liquid effluents into the Peace, Athabasca and Slave rivers and their major tributaries. From government and industry sources, assemble comprehensive historical data pertaining to the nature and ecotoxicity of these effluents as well as the treatment technology employed.

b) From the above, select one effluent source and enter all relevant data into a prototype geo-referenced (to facilitate GIS utilization of the data), electronic database (dBase IV format), and prepare tables, graphs and statistics of the data. The prototype database is then to be reviewed by the Project Liaison Officer and others associated with the NRBS for its consistency with other NRBS databases and ease of use. The database is to include comprehensive data on nutrients (N, P, C, BOD, etc.), contaminants (metals, organics, sulphides, compounds that cause taste and odour problems, etc.) and pathogens (microbiology) associated with liquid effluent discharges, as well as the results of toxicological tests of these effluents. The database is also to include comprehensive information on the types of treatment systems employed and the physical nature of the discharges (ie., the volume, timing, duration, loading and concentrations of discharges).

c) Review the prototype database with the Project Liaison Officer and modify the format of the database as directed by the Project Liaison Officer. Utilizing the agreed to format, enter all remaining data for all municipal and non-pulp mill effluent sources and prepare appropriate tables, graphs and statistics.

d) Prepare a concise technical report on the database system including a guide for users, dictionary and any other pertinent specifications of the electronic database submission.

3) Synthesis Report

a) Based on the data compiled in 2, above, as well as other information sources, prepare a comprehensive synthesis report discussing the nature of liquid effluents from non-pulp mill and municipal sources and the impacts or potential impacts of these

effluents on the aquatic ecosystems of the northern rivers. The report should be similar in style and content, with the exception that it will contain greater discussion on ecotoxicity, to McCubbin and Folke (1992).

b) The synthesis report is to include the following:

- information on the location of non-pulp mill industry and municipal effluent sources in the Study Area and relative to pulp mill effluent sources (include 1:250,000 or greater maps);
- a discussion on the chemistry, ecotoxicology and microbiology of discharges, including a statistical summary of the parameters discussed;
- a discussion of the physical nature of liquid effluent discharges (ie., timing, duration, quantities, loading and concentration of discharges), including a statistical summary of the parameters discussed;
- a discussion of the impacts or potential impacts of non-pulp mill industry and municipal liquid effluent discharges on the aquatic environment;
- a discussion of the Quality Assurance/Quality Control measures imposed on data from various sources;
- to the extent possible, a discussion of licensing requirements for non-pulp mill industry and municipal discharges and compliance with these requirements (regulations);
- identification of information gaps and recommendations as to how information gaps can be resolved; and,
- an assessment of the relative importance of various non-pulp mill industry and municipal liquid effluents with respect to contaminant, pathogen (microbe) and nutrient loading in the Study Area.

c) The data, included in the databases compiled in 1 and 2, above, are to be included as hard copy appendices to the synthesis report. Reference to these appendices should be made in the main body of the report.

3. Reporting Requirements

1) Submit the initial database format, compiling effluent data from a single source, by a date to be decided upon by the Project Liaison Officer and Scientific Staff in consultation with the contractor.

2) Submit ten copies of the draft technical report for the electronic database and ten copies of the draft synthesis report to the Project Liaison Officer by a date to be decided upon by the Project Liaison Officer and Scientific Staff in consultation with the contractor. Also submit the "draft" electronic database on non-pulp mill industry and municipal effluent characterization and the "draft" electronic database on licensed effluent discharges in the northern river basins along with the draft technical report for the electronic database and the draft synthesis report.

3) Submit final reports of the technical report for the electronic database and the synthesis report to the Project Liaison Officer three weeks after the receipt of the review comments on the draft reports. Five cerlox bound copies and two camera-ready original of each final report are to be submitted to the Project Liaison Officer. Electronic copies, in Word Perfect 5.1 format, of each report are also to be submitted on a 5 1/4 or 3 1/2 inch floppy disk to the Project Liaison Officer. The synthesis report is to include an executive summary.

4) Specific data contained within tables, figures and appendices of the final synthesis report must be placed in a dBase IV file on a 5 1/4 or 3 1/2 inch floppy disk and submitted to the Project Liaison Officer along with the final report.

5) Submit the final electronic databases to the Project Liaison Officer three weeks after receipt of the reviewed databases.

III. Contaminants in Aquatic Ecosystems - Annotated Bibliography and Synthesis Report

1. Objective

The purpose of this project is to prepare an annotated bibliography and expert synthesis report on contaminants found in the ambient aquatic environment of the northern rivers and their potential impacts and ecotoxicological effects on the aquatic ecosystem.

2. Requirements

1. Annotated Bibliography

Prepare an annotated bibliography of databases (indicate whether the database exists in hard copy or electronic format), government and non-government reports, journal reports, book chapters, student theses, etc. pertaining to chemical and microbial contaminants existing in the aquatic environment (water, sediment, biota) and potential impacts and ecotoxicological effects of these contaminants to aquatic ecosystems. Factors such as loading persistence, bioaccumulation and toxicity should be used as search criteria. Discussion is to be presented regarding the adequacy of Quality Assurance/Quality Control measures imposed on data.

2. Synthesis Report

a) Prepare an expert synthesis report from the information and data assembled in 1, above, on contaminants (chemical and microbial) found in the aquatic environment (water, sediment, biota) of the northern rivers and their potential impacts and ecotoxicological effects.

b) The report is to include the following:

- a comparison of the findings to present trends in effluent quality/quantity in the study area;
- summary statistics about the types and levels of contaminants present;
- a discussion of the ecotoxicological significance, including significance to human health, of contaminants and their concentrations;
- an assessment of the significance of the presence, concentration and distribution of contaminants found in the aquatic environment;
- a discussion of the presence, concentration and distribution of contaminants in the aquatic environment with respect to water quality guidelines and objectives;
- a discussion of information gaps regarding potential toxic effects of contaminants in the study area, including parameters requiring monitoring, etc.; and,
- a discussion of the Quality Assurance/Quality Control measures imposed on data considered in this report.

3. Reporting Requirements

1) Submit ten copies of the draft annotated bibliography and ten copies of the draft synthesis report by a date to be decided upon by the Project Liaison Officer and Scientific Staff in consultation with the contractor.

2) Three weeks after the receipt of review comments on the draft annotated bibliography and draft synthesis report, submit five cerlox bound copies and two camera-ready originals of each final report to the Project Liaison Officer. The synthesis report is to include an executive summary.

3) An electronic copy, in Word Perfect 5.1 format, of both the annotated bibliography and synthesis report are to be submitted to the Project Liaison Officer on 5 1/4 or 3 1/2 inch floppy disk along with the final reports.

4) Specific data contained within tables, figures and appendices of the final annotated bibliography and synthesis report must be placed in dBase IV files and submitted to the Project Liaison Officer at the same time as the final reports.

IV. Ecotoxicity of Pulp Mill Effluents

1. Objective

The purpose of this project is to prepare an annotated bibliography and expert synthesis report pertaining to the acute and chronic toxic effects of pulp mill effluents discharged into the northern rivers.

2. Requirements

1. Annotated Bibliography

Prepare an annotated bibliography of databases (indicate whether the database exist in hard copy or electronic form), government and non-government reports, journal reports, book chapters, student theses, etc. pertaining to the ecotoxicity of pulp mill effluents. This is to include information specific to the northern rivers, as well as major review papers on pulp mill effluent toxicity.

2. Synthesis Report

a) Prepare an expert synthesis report from the data and information assembled in 1 above, on the ecotoxicity of pulp mill effluents in the Study Area.

b) The report is to include the following:

- consideration of both actual toxicity and the volume of effluent discharges (ie., the "load" of toxicity);
- a comparison of the findings to present trends in effluent quality/quantity in the study area;
- a discussion of the ecotoxicological significance, including significance to human health, of pulp mill effluents and their concentrations; and
- a discussion of information gaps regarding the potential toxic effects of pulp mill effluents in the study area, including recommendations for further monitoring and study, etc.

3. Reporting Requirements

1) Submit ten copies of the draft annotated bibliography and ten copies of the draft synthesis report to the Project Liaison Officer by a date decided upon by the Project Liaison Officer and Scientific Staff in consultation with the contractor.

2) Three weeks after the receipt of review comments on the draft annotated bibliography and draft synthesis report, submit five cerlox bound copies and two camera-ready originals of each final report to the Project Liaison Officer. The synthesis report is to include an executive summary.

3) An electronic copy, in Word Perfect 5.1 format, of both the annotated bibliography and synthesis report are to be submitted to the Project Liaison Officer on 5 1/4 or 3 1/2 inch floppy disk along with the final reports.

4) Specific data contained within tables, figures and appendices of the final annotated bibliography and synthesis report must be placed in dBase IV files and submitted to the Project Liaison Officer at the same time as the final reports.

V. Literature Cited

McCubbin, N. and J. Folke. 1992 (November). Review of literature on characteristics of pulp and paper mills in northern river basins of Alberta, BC and Northwest Territories. Prepared for: Northern River Basins Study. Prepared by: N. McCubbin Consultants Inc.

APPENDIX E

ANNOTATED BIBLIOGRAPHY DATA FILES

APPENDIX E: ANNOTATED BIBLIOGRAPHY DATA FILES

This appendix is provided on the disk bound as the last page of this report; it contains the annotated bibliography database files and is described in Northern River Basins Study's Project Report No. 144.

The disk comprising this Appendix contains three files, using 48,790 bytes.

1. INSTALL.BAT; being 74 bytes in size.
2. PR144.EXE; being 48,230 in size.
3. DISCLAIM.TXT; being 486 bytes in size.

To install the annotated bibliography database, copy the three files on this disk to a directory on your hard drive and type install.bat. The result will be 4 files totalling 440,036 bytes. To use the files with extension .DBF requires dBase IV.

There is no warranty expressed or implied for the use of this database; the Northern River Basins Study does not guarantee the accuracy of the data. The NRBS does not assume any liability for actions or consequences resulting from the use of the data; individuals using this data do so entirely at their own risk. The NRBS will not update the data except as deemed necessary for its own purposes.