

LE FLEUVE

St. Lawrence Action Plan Newsletter

Vol. 3, No. 4, September 1992

CHIMIOTOX: MEASURING THE REDUCTION IN TOXIC LIQUID WASTE

St. Lawrence Action Plan's primary objective is, by 1993, to achieve a 90% reduction in the amount of toxic liquid waste being dumped in the St. Lawrence River by the 50 companies targeted for priority action. Insiders call this the "90-50-93" objective.

"The problem was, we had no instrument to measure overall toxicity," says Gaétan Duchesneau, Director of Technical Services with SLAP's Joint Action Group. "And yet, that 90% figure is key to operation 90-50-93; it's what the public is going to judge us on. We had to come up with something."

The Mother of Invention...

"Working with the consulting engineering firm, SNC, we developed an indicator that takes into account the relative toxicity of pollutants in the same effluent," continues Mr. Duchesneau. "We call it **chimiotox**, a combination of 'chemical' and 'toxic,' and we use it to assess chemical pollution in the river in **chimiotox units**."

A single manufacturing plant can dump more than 100 so-called "priority" chemical pollutants into one river. The toxicity of each pollutant, however, can vary greatly as much as the amount of pollutants from one plant to another. The Plan needed an overall picture of this toxic mass, and a method for including all the pollutants in a single calculation.

Using a Common Denominator

Initially, the Joint Action Group decided



J.M. Coulombe - Environment Canada

*The **chimiotox** model provides a quantitative index of the relative toxicity of industrial effluent.*

to use the 120 chemical parameters most likely to be found in the river. But how were they going to find a common basis for comparing them all?

Take toxicity, for example. Not only does it vary from one parameter to the next, but it can vary for the same parameter, depending on whether you're measuring domestic water supply, contaminated aquatic organisms or aquatic life; aquatic life is further divided into cases of either acute or chronic toxicity. The MENVIQ brochure, *Water Quality Criteria* (1990) contains the data banks corresponding to these four categories.

The first decision made by the creators of **chimiotox** was to go with the strictest

criterion and use one part per million as the basis for reference.

A toxicity factor is arrived at by simply dividing the reference by the strictest criterion. The relative toxicity for each of the 120 parameters can thus be obtained, which means they can be compared to each other and eventually added together.

Looking Back and Looking Ahead

Samples were taken from the first 30 industrial plants in 1990 and 1991, but the results were measured against 1988 figures. How? SLAP experts translated into **chimiotox units** the effects of any new equipment that

might have been added since 1988. These units were added to the total to get a picture of the base year. This way, they can also predict the effect of treatment systems that will be implemented between now and 1993 to meet either new regulations or the 90% objective.

"Chimiotox does not replace conventional approaches," cautions MENVIQ's Gilles Legault. "It does not take into account the capacity of the receiving body of water, acidity, or the effect of substances on each other in a given effluent. Chimiotox measures only what comes out of the pipe and is helpful in providing additional information about the relative importance of each toxic pollutant."

A Model with a Future

Chimiotox has been presented at a number of forums on the environment and the scientific community has had a chance to evaluate it. So far, the results are encouraging (see box).

"Chimiotox makes the abstract notion of toxicity more accessible," says Gaétan Duchesneau. "It's a qualitative tool that paints a concrete picture. It also has many possible applications. For example, the same principle could be used to manage atmospheric pollution, as well. One thing is certain: we now have an excellent means for comparing current toxic waste with 1988 figures, taken before the Joint Action Group was set up."

WHAT THE EXPERTS THINK

Perry D. Anderson, Concordia University: "Chimiotox is an indispensable tool for managing industrial effluent. This model makes it possible to establish an integrated framework for managing the environment.

"I have a few reservations about the toxic weighting factors used, in particular with regard to the safety factor of 10^{-6} for known carcinogens. Similarly, given the lack of scientific measurement, the F_{tox} should be determined using models for predicting toxicity based on the chemical similarity of pollutants. Aside from these methodological concerns, however, I agree with both the concept and current application of chimiotox."

Michel J. Bertrand, University of Montréal: "In theory, Chimiotox could be an interesting tool for managing toxic waste. But the way in which the model is applied limits its practical effectiveness.

"In particular, I would criticize the use of a restrictive list of priority pollutants, the excessively broad range of weighting factors and the undesirable addition of chimiotox units for organic and inorganic substances. Still, chimiotox could achieve its main objectives if the weighting factors were more restricted, if the most effective analytical methods were used and if the samples from a given plant were taken far enough apart to represent a true picture of the plant effluent and the changes occurring."

Jacques Boisvert, University of Québec at Trois-Rivières: "Aside from a few methodological problems, Chimiotox is an excellent tool for managing toxic waste. The model should be taken for what it is: a basis for work, management or discussion, but not for interpretation. The model determines pollution levels at the source, which allows us to visualize the actual amount of pollutants being released into the water.

"Conceptually, chimiotox is very valid: the use of toxic weighting factors based on solid scientific data, even though that data may be incomplete, and the use of the 'strictest criterion' are perfectly justified.

Chimiotox units are a faithful index of the toxic potential of industrial effluent.

"Some of the model's methodology requires particular attention, however: the minimal amount of time spent characterizing the waste from a given plant and the significant difference between the criteria supplied by the four data banks used, for example."

Raymond Desjardins, École Polytechnique: "Chimiotox is not a simplistic response to a complex problem: it just has to be seen in the proper perspective. Chimiotox does not replace biotesting or environmental evaluation. It can, however, help to quickly detect the primary substances responsible for toxicity and allow wastes from different sources to be compared.

"I agree with the main elements of the model: the use of the 'strictest criterion'; the calculation of the F_{tox} ; and adding the results to obtain a chimiotox index. However, the water quality criteria should be reviewed, especially for substances with weak criteria and for haloforms.

"Overall, chimiotox is an excellent tool that allows the toxic character of a substance or group of substances to be illustrated."

André Hade, University of Québec at Montréal: "The chimiotox model is based on valid principles and it has been properly developed. The team is thoroughly justified in using it to express the toxic weighting of industrial effluent and to follow changes in that effluent over time.

"The scientific notions developed in the chimiotox model are adequate, and despite certain limitations that have already been pointed out, the model can produce a good index of effluent toxicity.

"The expression of the F_{tox} and UC values should, however, be limited to significant figures corresponding to the precision of analytical measurements and toxicological criteria. Lastly, the model may provide an opportunity to replace the erroneous expression 'total solids' with 'dry residues.'"

PARTNERS

THE ENVIRONMENTAL BIO-INDUSTRY COUNCIL

The Environmental Bio-Industry Council is a non-profit agency created to promote the development of environmental biotechnologies and establish a national and international network in the field. The Council manages research and development projects carried out by the users and producers of biotechnologies.

The Council's objectives are to promote cooperation between industry, government and universities; to make the public aware of how environmental biotechnologies are managed; to help corporations meet anti-pollution standards; to act as spokesperson for environmental bio-industries in Canada; and to assume a leadership role within the international community.

As a partner in the St. Lawrence Action Plan, the Council organizes various activities designed to demonstrate the value of biotechnologies. The three main areas in which it is involved are biological cleanup processes; clean technologies, such as using enzymes to bleach wood pulp; and biological products, such as biofertilizers and biopesticides. On May 15 of this year, the Council and SLAP organized a technical conference on contaminated sites; three other meetings on topics to be announced are planned for the fall.

For more information, contact the Environmental Bio-Technology Council at 535, Cartier Blvd., Laval, Québec, H7N 4Z9. The phone number is (514) 662-4063.

NEW INDUSTRIAL CLEAN-UP PROJECTS: SCIENCE AND INDUSTRY MAKE GOOD PARTNERS

Industrial pollution control is the focus of special attention under the St. Lawrence Action Plan.

And it's clear that clean-up projects are making increasing use of technical advances.

The following are just two of the more recent initiatives in the field.

ASC SIGNS ON WITH A WATER PURIFICATION PROGRAM FOR THE JONQUIÈRE COMPLEX

Alcan Smelters and Chemicals (ASC) has just had its water purification program for the Jonquière Complex approved by the Ministère de l'Environnement du Québec. The program is the culmination of four years of work involving waste characterization studies, an analysis of production processes and a full examination of possible solutions. The program will affect the Complex's two production centres at Arvida and Vaudreuil: the Arvida plants produce primary aluminum, while Vaudreuil is a major centre for inorganic chemicals.

The clean-up will take place in two stages. The goal of the first stage is to reduce the level of contaminants

coming from contact water, industrial process water, resurgent water and domestic sewage. The domestic water system will also be connected to the Jonquière municipal sewage treatment plant. The process began in 1991 and should be completed by 1995.

The second stage, from 1996 to 1999, will see the completion of various projects to control contact and run-off waters and reduce the infiltration of pollutants in the domestic water supply. Equipment to treat final effluent may even be installed, if necessary.

"Our water clean-up program is another part of a process begun some years ago to improve environmental quality at the Jonquière Complex," explains Jacques Labrie, senior chemist at ASC. "This is an important step in reducing industrial waste containing sodium hydroxide, aluminum, fluorides and cyanides."

Every day, a total of 70,000 m³ of effluent flows into the Saguenay River from three pipes at the Jonquière Complex. At the moment, 13 sampling stations along the drainage system monitor the wastewater composition. Under the new program, additional monitoring equipment will be set up around the edge of the complex, existing sampling equipment will be upgraded, frequent and detailed analyses of the effluent content will be made and improvements in the wastewater will be carefully evaluated.

"We have already implemented the first of these projects," notes Mr. Labrie, "and we're confident that the agreement deadlines will be met."

In the Saguenay Marine Park, the tidal flats, flood plains and run-off plains located all along the Saguenay River are areas of vital environmental importance: not only do they act as natural water filters, they are also home to a rich variety of aquatic flora and fauna, including many species of waterfowl. Sport fishing is also a key attraction, drawing anglers in search of smelt, brook trout, pike, walleye, whitefish, perch and salmon.

"Over the last ten years, we've managed to reduce the level of certain pollutants in our effluent by 50 to 85%," says Mr. Labrie. "We are increasingly aware of our role in safeguarding the environment; and we're taking action by pursuing new, non-polluting techniques."

Right now, there are no federal or provincial regulations regarding the liquid effluent from aluminum smelters. However, the Ministère de l'Environnement du Québec and the SLAP Joint Action Group maintain control over the



Aerial view of the Alcan facilities at Jonquière. The Saguenay River is at the top of the picture.

Alcan

effluent and work with industry to reduce pollutants.

"ASC's water treatment program is primarily geared toward reducing waste at the Jonquière Complex source," explains Robert Tétreault, director of the SLAP Joint Action Team. "Using the latest technology helps us achieve our goal and protect the waters into which the effluent flows."

THE MEMBRANE BIOREACTOR: A FINE EXAMPLE OF TECHNOLOGICAL PROGRESS

Some industrial effluents are difficult to treat using conventional biological processes. Loaded industrial wastewater, for example, or wastes containing toxic substances present a major problem, particularly given new environmental standards.

For this reason, a number of industrial companies, including the Reynolds aluminum smelter at Cap-de-la-Madeleine and Nacan, the organic chemicals company, are currently examining the possibility of using a new biological treatment technique: the membrane bioreactor. It is hoped that this method will considerably reduce the amount of toxic waste going into the St. Lawrence River.

What distinguishes this process from the others is that instead of using conventional separation methods, like decanting, it filters the contaminated water through a membrane. There are two options with filtering: microfiltration allows for greater flow but extracts only the biomass, while ultrafiltration allows emulsified oils and grease to be trapped for biodegradation, but at the cost of a greatly reduced flow.

The membrane bioreactor is made up of a biological reactor that can operate in either an aerobic or anaerobic environment, and a membrane filter module. The hydraulic residence time in the reactor is thus separated from the sludge residence time in the filter and consequently, the biomass can be more highly concentrated.

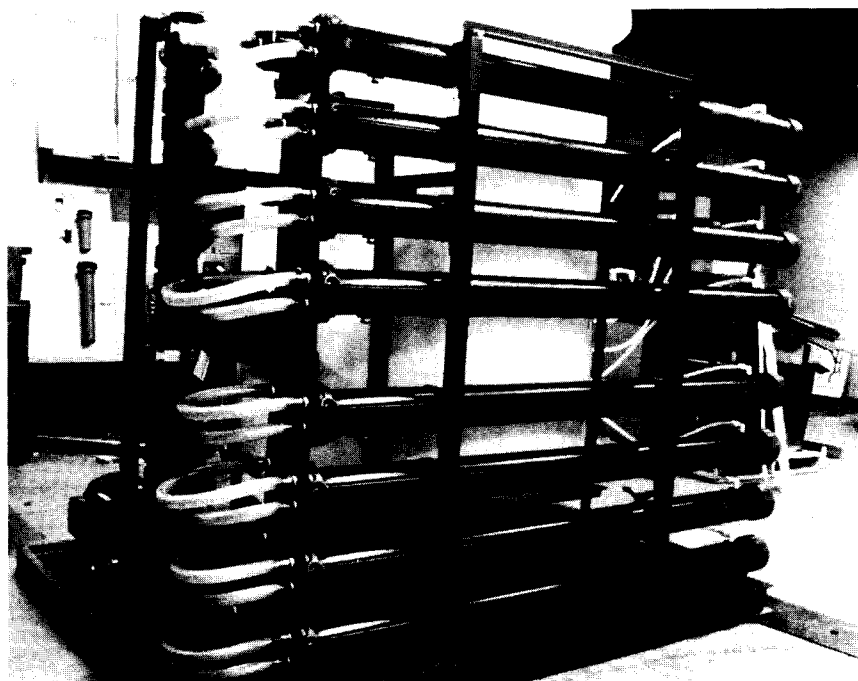
"There are three main advantages to this process," explains Bernard Dussault, an engineer with Zénon Environnement Inc., the company that developed the ZenoGem process being tested by Nacan and Reynolds. "First of all, there's the quality of the treatment: you get both total clarification of the effluent and biodegradation of refractory products like emulsified oils and grease.

"Second, it's easy to use, even when you're dealing with a highly concentrated biomass. And lastly, the cost of treatment is lower than with

Canada's St. Lawrence Centre with a view to developing a new technique for treating effluent that is not easily biodegradable. As we went to press, however, the feasibility studies had not yet been completed.

Reynolds has also shown interest in the membrane bioreactor, especially since the company already uses the ultrafiltration technique at its Cap-de-la-Madeleine plant to extract the greatest amount of water from oil/water emulsions.

Adding a bioreactor to the ultrafiltration process could reduce the



Zénon Environnement inc.

A typical ultrafiltration unit for the ZenoGem bioreactor.

conventional processes for a number of reasons, including the fact that a smaller volume of sludge is produced, since the biomass is more highly mineralized than with ordinary treatment methods."

Produits Nacan ltée of Boucherville operates a water treatment plant that will in future be connected to a municipal treatment centre. Its effluent, which already meets Ministère de l'Environnement standards, will thus be treated twice.

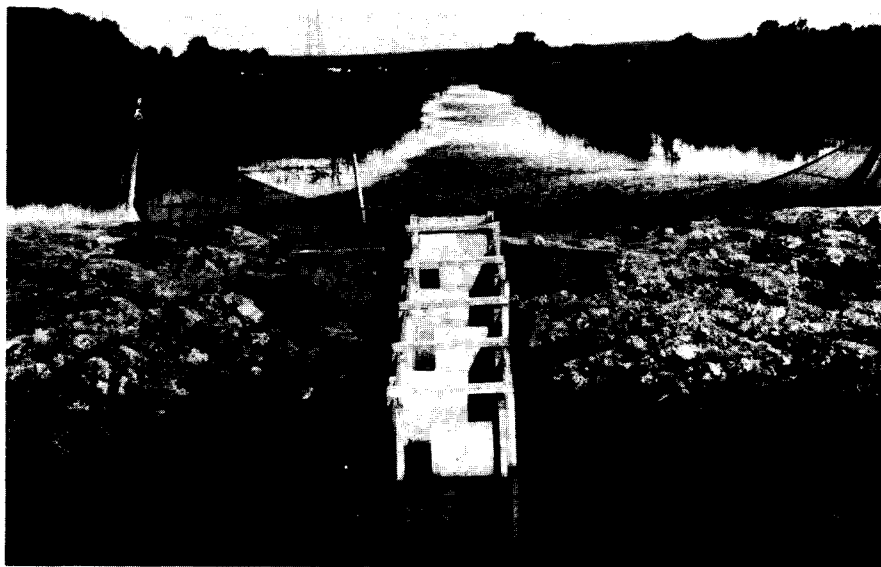
Nacan has undertaken a series of tests in cooperation with Zénon Environnement and Environment

cost of treating the by-products of the lamination process. In fact, the amount of sludge separated from the water would be considerably lower, compared to ultrafiltration alone. Unfortunately, the results of tests at the Reynolds plant are not yet available.

Given its attractive cost/efficiency ratio, the new process shows great promise. Work currently being done should produce an even better ratio in the relatively near future, the result of larger filtration surfaces and increased flow within the system, all at lower energy and operating costs.

SPAWNING IN DAMMED MARSHLANDS: A POSSIBLE SOLUTION

Ducks Unlimited Canada



A fishway with alternating notches.

Improving waterfowl habitats sometimes requires the damming of marshlands. But what happens to the fish that spawn in these areas? And what can be done to help them? These are some of the issues being tackled by the Ministère du Loisir, de la Chasse et de la Pêche du Québec (MLCP) and Ducks Unlimited Canada. Additional financial assistance is coming from the Fondation de la faune du Québec (Quebec Wildlife Foundation) and the Department of Fisheries and Oceans of Canada (DFO).

These organizations and government departments are all partners in a five-year study that began in June 1988. It focuses on the needs of non-waterfowl species affected by the marshland reorganization handled by Ducks Unlimited. Close to \$600,000 has been allocated for the study, which is being conducted in several areas, including a dammed marsh on Île Dupas. The results of the study fall under the St. Lawrence Action Plan's Conservation Branch program to preserve wildlife habitats and endangered species.

What Exactly Was the Problem?

"Marshes that are dammed retain more water," explains Jean Landry of Ducks Unlimited. "During the spring thaw, the water level rises, but then, when the level drops, the fish and their spawn are imprisoned in the marsh. Also, some species, like the largemouth bass and certain pan fish spawn well after the water level drops, but they can't get into the marsh when they need to."

The solution was to set up a system of fishways that would allow the fish to get in and out of the marsh as required by their spawning needs.

Fish like the salmon have no trouble swimming upstream and jumping rapids when going to spawn. But marsh fish are "precision swimmers, not power swimmers," says Mr. Landry. "They are affected by strong currents and therefore the kind of notches you put in the fishways is very important."

After an exhaustive study, five types of fishways were submitted for testing last June. By far the most successful was the one with connecting pools and vertically aligned notches, which allowed the most fish to migrate. Nearly 800 fish of all sizes and ages from ten

different species used this one. As expected, this particular fishway also produced the strongest acceleration in the current downstream from it.

Before making a definite decision as to which system to use, another aspect of the problem must be examined. "In June, we studied how the fish migrated upstream into the marsh," says Mr. Landry. "In August, we did a similar study to see how they swam out, which was by allowing themselves to be carried along by the natural drop in the pass."

Conservation experts are already envisaging how wetlands might be organized to promote the breeding of various economically important wildlife species, such as waterfowl, fish and muskrat, all in the same environment. We can therefore expect this experiment to be repeated in a number of areas designated by SLAP.

The 15th International Symposium on Wastewater Treatment and the 4th Workshop on Drinking Water

A MODEL OF UNIVERSITY/INDUSTRY COOPERATION

Since it first began, Montréal's International Symposium on Wastewater Treatment has adopted a global scope. The event has become one of North America's most important forums in the field: last year, it attracted close to 400 engineers from around the world, as both speakers and spectators. The Symposium is for academics, researchers, engineers, technologists, operators and designers of water purification plants and stations. It is organized under the aegis of the Association québécoise des techniques de l'eau (AQTE), Environment Canada, the Ministère de l'Environnement du Québec and the Société québécoise d'assainissement des eaux. The 15th edition of the Symposium will take place November 17-19, 1992. Guest speakers will present their latest findings on a variety of topics, including the treatment of industrial effluent, sludge treatment, wastewater

treatment for small communities and municipalities, and the operation of treatment plants. These topics are particularly relevant for Québec, which now has 280 such plants.

The program for the Symposium is being finalized, and it's safe to say that the Symposium will once again prove to be the place to find out about the latest developments in industrial and domestic wastewater treatment.

For the last three years, a workshop on drinking water has been part of the Symposium. Topics include new treatment techniques, quality control in drinking water systems and setting new objectives for reducing waste levels. The success of this workshop is particularly important, given the public's growing concern for the quality of drinking water in the province.

HOT OFF THE PRESS

THE RIVER...IN BRIEF

Instant-info fact sheets prepared by Environment Canada's St. Lawrence Centre under the St. Lawrence Action Plan are part of a series of publications designed to keep people informed about the state of the river. They are published and updated regularly.

So far, the collection includes 40 fact sheets dealing with geographical, biological, physical, chemical and socio-economic aspects of the St. Lawrence. There's information on a wide variety of topics, including Native reserves found along the river's shores, festivals involving the river, pleasure boating, whale watching and the river's main islands and archipelagos.

The fact sheets are full of maps, charts and black-and-white illustrations. Listed by topic, they're very useful for research.

English versions are being prepared, but for now, they're available in French only. Contact: Knowledge of the State of the Environment Branch, St. Lawrence Centre, Conservation and Protection, Environment Canada, 105 McGill St., 4th floor, Montréal, Québec, H2Y 2E7. The phone number is (514) 283-7000.



READINGS

EATING FRESHWATER FISH CAUGHT IN QUÉBEC: A GUIDE FOR SPORT FISHING ENTHUSIASTS

The Ministère de l'Environnement du Québec, in cooperation with the Ministère de la Santé et des Services sociaux and the Centre de Toxicologie du Québec, has just published the third edition of the *Guide de consommation du poisson de pêche sportive en eau douce*. The booklet is designed for sport fishing enthusiasts and people who regularly eat freshwater fish caught in Québec waters. Using data gathered between 1978 and 1990, it assesses 300 sites in the province, based on the level of chemical pollutants found in various species.

Easy-to-read tables indicate the recommended number of meals per month for each species, according to the size of the fish and place of origin. The recommendations are designed to avoid an excessive accumulation of contaminants in the body over periods that may be as long as an entire lifetime. An index of the hydrographic basins studied appears at the end of the guide.

The 80-page booklet also includes hydrographic maps by area, information on pollutants and their effects on the human body, photographs of several fish species and delicious fish recipes. The guide, which is published in French only, is available in community health centres, CLSCs and regional offices of the Ministère de l'Environnement and the Ministère du Loisir, de la Chasse et de la Pêche du Québec.

1992 STATUS REPORT ON QUÉBEC FAUNA

This first report on the status of Québec fauna, published by the Ministère du Loisir, de la Chasse et de la Pêche du Québec (MLCP), covers the 638 species of vertebrates living in the province. It includes a removable, large-scale chart indicating where these species can be found, their approximate populations and whether they are on the rise or in decline.

The first five chapters deal with small mammals, large mammals, birds, amphibians and reptiles, and fish, in that order. The next section covers insects—invertebrates that nonetheless make up an important part of Québec fauna.



READINGS (continued)

The third section takes a look at certain wildlife habitats, such as heronries and mud flats, while the last chapter is devoted entirely to threatened or endangered species.

A number of species, such as the lynx, the beaver and the lake trout are examined in greater detail, either because of their particular situation, or because their populations have varied significantly over the last five years.

The report, which also includes many informative charts and maps, can be obtained by writing to the Ministère du Loisir, de la Chasse et de la Pêche du Québec, Direction du marketing et des communications, 150 Saint-Cyrille Blvd. East, 10th floor, Québec City, Québec, G1R 4Y1.

IN BRIEF

FRANCE-QUÉBEC CONFERENCE ON THE USE OF MODERN TECHNOLOGY IN MANAGING FRESHWATER AND DIADROMOUS FISH

The second France-Québec Conference on the Use of Modern Technology in Managing Freshwater and Diadromous Fish was held in Montréal from May 31 to June 3, 1992.

The event, which was organized by the Ministère du Loisir, de la Chasse et de la Pêche du Québec (MLCP) brought together experts from the private and public sectors, as well as representatives from university research centres in both Québec and France, for presentations and dialogue on four topics.

The first topic—monitoring fish stocks and the fish harvest—elicited plenty of interest, particularly with regard to the use of fishways to monitor the stocks and manage migratory fish populations.

As for fish farming and replenishing the stocks, we can expect to see an increase in the popularity of diversion incubators (incubators placed in quieter branches of a waterway), which seem to be producing promising results in Québec. In addition, a new expert system for identifying fish diseases was introduced. It is an interactive system that uses artificial intelligence and does not require that the user have prior training in fish pathology.

Fish habitat was the third topic. It provided an opportunity to examine, among other things, the simulation of micro-habitats, which relates fish activities to particular physical aspects of micro-habitats. The simulation is an important Québec breakthrough and may soon be in use in many other countries.

The fourth topic covered the human aspect of fish management. "Several studies conducted with different groups showed us that the general public is now aware of environmental issues" explains Pierre Bérubé of the MLCP. "This is a situation that governments can no longer ignore."

CONTACTS

CHIMIOTOX: MEASURING THE REDUCTION IN TOXIC WASTE

Gaétan Duchesneau
(514) 873-9480
SLAP Joint Action Group
Gilles Legault
(514) 873-4616
Ministère de l'Environnement du Québec

ASC SIGNS ON WITH A WATER PURIFICATION PROGRAM FOR THE JONQUIÈRE COMPLEX

Robert Tétreault
(514) 873-9152
SLAP Joint Action Group
Jacques Labrie
(418) 699-2297
ASC Jonquière

THE MEMBRANE BIOREACTOR: A FINE EXAMPLE OF TECHNOLOGICAL PROGRESS

Bernard Dussault
(514) 493-4733
Zénon Environnement inc.
Richard Hallé
(819) 373-6305
Reynolds Aluminum Company of Canada
Normand Lanthier
(514) 655-2220
Produits Nacan ltée
Ronald Zaloum
(514) 283-4252
St. Lawrence Centre
Environnement Canada

SPAWNING IN DAMMED MARSHLANDS: A POSSIBLE SOLUTION

Jean Landry
(418) 623-1650
Ducks Unlimited Canada
Claude Grondin
(418) 644-8120
Ministère du Loisir, de la Chasse et de la Pêche du Québec

The 15th International Symposium on Wastewater Treatment and the 4th Workshop on Drinking Water

A MODEL OF UNIVERSITY/INDUSTRY COOPERATION

Éric Bouchard
(514) 874-3700
Association québécoise des techniques de l'eau
Kamal Karazivan
(514) 873-3335
Ministère de l'Environnement du Québec



COMING EVENTS

THE WATERWAYS FOR THE WORLD INTERNATIONAL SYMPOSIUM

The Waterways for the World International Symposium will be held at Montréal's Queen Elizabeth Hotel on October 13-15, 1992. The theme of the conference is "From the Earth Summit to the Sustainable Development of the World's Great Rivers," and it is being organized jointly by the Société de développement économique du Saint-Laurent (SODES), the University of Québec at Montréal and Environment Canada's St. Lawrence Centre.

In keeping with the United Nations Summit on development and the environment, this conference seeks ways to reconcile economic demands and environmental imperatives; it also works to establish a network for the exchange of expertise on the great rivers of the world. Renowned speakers from around the world and experts who manage many of the planet's major rivers will address an international audience of business people, government representatives and members of the academic community, all of whom are concerned about the environment.

On October 14 and 15, concrete achievements and promising new techniques for protecting and restoring our great rivers will be the focus of a special exhibit.

For information and a complete schedule of events, please contact:

Johanne Léveillé
Réceptions et Congrès
Phone: (514) 384-4010
Fax: (514) 384-0524

AQTE 15th SYMPOSIUM

The Association québécoise des techniques de l'eau (AQTE) will present the 15th International Symposium on Wastewater Treatment and the 4th Workshop on Drinking Water, November 17-19, 1992, in Montréal. The two events are among the most important forums in the field in North America, and are expected to draw a significant number of international-calibre speakers who will present papers on their latest work.

For more information, please contact the Association:

AQTE - Symposium 92
407 St. Lawrence Blvd.
Suite 500
Montréal, Québec
H2Y 2Y5
Phone: (514) 874-3700
Fax: (514) 866-4020

CONTACTS (continued)

Partners

THE ENVIRONMENTAL BIO-INDUSTRY COUNCIL

Yvan Valiquette
(514) 283-3557
St. Lawrence Centre
Environment Canada
Yvon Brousseau
(514) 662-4063
Environmental Bio-Industry Council

In Brief

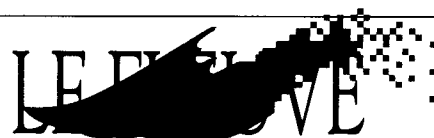
FRANCE-QUÉBEC CONFERENCE ON THE USE OF MODERN TECHNOLOGY IN MANAGING FRESHWATER AND DIADROMOUS FISH

Fay Cotton
(418) 643-5446
Ministère du Loisir, de la Chasse et de la Pêche
du Québec
Pierre Bérubé
(418) 643-5446
Ministère du Loisir, de la Chasse et de la Pêche
du Québec

EDITOR'S NOTE

In the last issue of *Le Fleuve*, we mentioned the publication of a guide for managing large rivers. Please note that this guide, the exact title of which is *Seminars on River Ecosystem Management*, is available in limited numbers only for consultation at the documentation centre of Environment Canada's St. Lawrence Centre.

For more information, please contact Mr. Jean Burton, Assistant Director of the St. Lawrence Centre, at (514) 283-2343.



St. Lawrence Action Plan Newsletter

LE FLEUVE is published four times a year by Environment Canada's Conservation and Protection Branch in collaboration with the Quebec's Ministère de l'Environnement and the Quebec's Ministère du Loisir, de la Chasse et de la Pêche. It is distributed free of charge to individuals, companies and organizations involved in the protection, conservation and restoration of the St. Lawrence River. To subscribe, contact: Conservation and Protection, Environment Canada, 1179 rue de Bleury, 4th floor, Montréal, Québec, H3B 3H9
Tel: (514) 283-0198

Production: Massy-Forget Communications Ltd

Production coordination for
Environment Canada: Thérèse Drapeau

These texts may be reproduced provided the source is mentioned.

The masculine form has been used in this document without discrimination and solely for reasons of style.



LE FLEUVE
is printed on
recycled paper.

ISSN 0847-5334

Legal Deposit: National Library of Canada
Bibliothèque nationale du Québec
3rd Quarter 1992

LE FLEUVE est disponible en français

Canada Québec