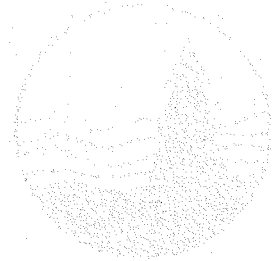


BIOQUAL

NEWSLETTER



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New Information Source Launched

This is the first issue of the BIOQUAL Newsletter. Authorized by the BIOQUAL Steering Committee, the Newsletter will be distributed free of charge to all BIOQUAL members. Its purpose will be to inform members of new developments in biotechnology as they relate to the preservation of the environment. New research, technology transfer, commercialization opportunities, upcoming workshops and conferences, and general interest items will be featured.

Socio-economic Analysis of Proposed Regulations

Environment Canada is developing New Substances Notification Regulations, Part III (Biotechnology Products) under the *Canadian Environmental Protection Act*. These regulations will apply to micro-organisms and products of organisms having uses that do

not fall under any other federal Act.

According to federal government policy, the socio-economic effects of all new regulations or amendments to existing regulations must be assessed and summarized in a Regulatory Impact Analysis Statement (RIAS). Environment Canada has formed a Steering Committee of representatives from Environment Canada, Health Canada, and Industry and Science Canada. Twenty-two persons representing various government, industry, academic, and environmental groups have been asked to serve on the Consultative Committee. This Committee will represent views of affected stakeholders, advise the Steering Committee on how to access the relevant background information, assist in designing the methodology for socio-economic studies, and periodically review draft reports of the studies. Glenn Allard, Director General of Environment Canada's Technology Development Directorate, is

representing BIOQUAL on the Consultative Committee and will be forwarding information about the RIAS process to other members.

The regulations will be subjected to a full cost benefit analysis when they are close to completion, most likely next spring. In the meantime, several background studies are planned. A background study on the

News Items Needed!

The BIOQUAL Secretariat compiles the information in this Newsletter. We will be pleased to print any items relevant to the objectives of the BIOQUAL network that you think may be of interest to members. Please send any submissions or enquiries to the Secretariat at the following address:

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Canadian biotechnology industry will begin in November.

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National Research Council and Imperial Oil Focus on Oil Sands

Imperial Oil Limited in Calgary and the National Research Council's Biotechnology Research Institute (BRI) in Montreal are collaborating on a new approach for extracting a higher quality of oil from the oil sands of western Canada. At the same time, they are trying to reduce the environmental impact of this extraction procedure.

The new technology, microbiological desulphurization, uses microbes to reduce the sulphur content of the oil, thereby reducing its viscosity and increasing its heating value. Combustion of petroleum products containing sulphur produces sulphur dioxide which, at high ground-level concentrations, can have harmful effects on the environment.

This research program could potentially reduce the costs of refining heavy oil into saleable petroleum products. Research to date has shown that the microbiological approach

removes sulphur from compounds that are difficult to treat using conventional refining technology.

Imperial Oil is a major developer of the oil sands through its operations at Cold Lake, Alberta, and its 25% interest in the Syncrude project near Fort McMurray, Alberta. Imperial's Calgary-based research centre has contracted BRI to conduct a six-month feasibility study on biodesulphurization of the oil sands. This is the first time Imperial Oil has applied biotechnology to its oil sands operations.

The BRI researchers will verify the effectiveness of an existing microbial strain provided by Imperial Oil and will try to identify new strains specific to the oil sands. Preliminary results will be available in April 1994.

Depending on the outcome, the collaboration of BRI and Imperial Oil could generate a long-term research and technology development program.

The initial agreement was signed in September 1993 by Dr. Robert Overfield, Manager, Oil Sands Research and Development of Imperial Oil, and by Dr. Michel Desrochers, Director General of the Biotechnology Research Institute.

Based in Montreal, the Biotechnology Research Institute is part of the National Research Council's Canada-wide network of national research facilities.

The BRI employs about 250 people and is actively involved in research and development in the pharmaceutical, bioprocessing, and environmental sectors.

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Export Market Development for Canadian Bioremediation Products and Services — Developing a Network of Canadian Companies

The Biotechnology Directorate of Industry and Science Canada (ISC) is working with Environment Canada and BIOQUAL, the Environmental Bio-Industries Council, the Industrial Biotechnology Association of Canada, universities, research organizations, and other interested groups to create a network of Canadian companies specializing in bioremediation and to identify and pursue market opportunities in foreign countries.

The market for bioremediation is growing at an annual rate of approximately 20% in North America and Europe. The growth rate is significantly higher in the emerging

economies of Latin America and Asia Pacific.

A number of Canadian companies, mostly small and medium in size (SMEs), are at the leading edge of technical developments in bioremediation. Because of their size, however, many of these companies lack the resources to successfully pursue business opportunities overseas.

A network of 10 to 15 SMEs with complementary capabilities could share and use resources to jointly identify and access more opportunities for exporting their products and services than could be done individually. Overall, the network would save members money, time, and effort, and contribute to their growth as well as that of the Canadian economy.

This initiative will involve a wide range of companies in both the private and public sectors. The lead must come from the private sector with government playing a supporting role.

At this early stage, the associations and ISC are identifying interested parties who may wish to participate in a workshop to discuss this opportunity and to form a core group to foster the development of such a network.

A key issue is to encourage companies that may be competitors to explore the advantages of working together through dialogue on common issues such as financing, accessing foreign markets, understanding regulatory barriers,

business management, and technical information.

Other specific issues that will need to be addressed at the appropriate time are cost of membership, sources of consortium funding, organizational framework, terms of reference, monitoring and control mechanisms, and identification and selection of export markets.

This initiative will involve:

- creating a list of Canadian companies highlighting individual expertise;
- contacting industry associations, government agencies, and others with potential interest in the pilot project;
- developing an information package with related material on markets and networks;
- sending out information package to "first wave" companies; and
- holding meetings to introduce the concept to companies.

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Oscillatory Flow-enhanced Bioventing

Bioventing is increasingly being recognized as an effective technology for removing biodegradable organic contaminants from unsaturated soils. It is an attractive alternative to conventional soil vacuum extraction systems because it can both treat volatile and non-volatile organic contaminants and limit or avoid the need to treat off-gas.

As with conventional soil vacuum extracton systems, however, bioventing systems are most effectively applied under homogeneous isotropic soil conditions where flow is uniform throughout the porous media. Under these conditions, all zones of contamination within the soil can effectively be accessed. Since homogeneous isotropic conditions are **never** encountered in the field, bioventing systems are subject to the same preferential flow limitations that plague soil vacuum extraction systems and groundwater pump and treat systems. Under static flow conditions typically used in soil-venting systems, layered and trending heterogeneities in soils may create major preferential flow paths in higher permeability zones. Because greater volumes of contaminant may often reside in lower permeability soils as a result of the greater total surface area and greater natural organic matter content, preferential flow through higher permeability soils may significantly limit the overall effectiveness of static flow soil-venting systems.

To overcome the preferential flow limitations experienced under static flow conditions, pulsed or oscillatory flow regimes can be imposed on the soil to better access lower permeability zones and "dead-end" pores and fractures. By varying pressure at specified frequencies in lower permeability zones and "dead-end" zones where contaminant removal would otherwise be subject to diffusion limitations, advective flow can theoretically be induced and/or enhanced to increase gas exchange and oxygen replenishment. When applied in an oscillatory mode of operation rather than a simple pulsed mode, further enhanced gas exchange would be expected through improved network flow within the soil. The combination of enhanced advective flow and network flow under an oscillatory flow regime would ultimately be expected to increase the overall rate of bioremediation.

Pre-field, bench-scale studies are currently in progress at the Wastewater Technology Centre in Burlington, Ontario and at Daniel B. Stephens & Associates, Inc. in Albuquerque, New Mexico to determine design parameters for field application.

In experiments with a silica/sand system, water vapour extraction rates were compared under oscillatory and static flow regimes. The results indicated that water vapour extraction was enhanced under oscillatory flow conditions. Based on these results, an experimental bench-scale apparatus was designed to

compare the effects of oscillatory flow with static flow on carbon dioxide (CO₂) production and oxygen (O₂) consumption in a hydrocarbon-contaminated soil. This comparative study is ongoing. If the results indicate that oscillatory flow significantly enhances biodegradation, a field study will be initiated.

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Development of a Protocol for Performing Bioremediation Treatability Studies

The use of bioremediation technologies at contaminated sites is increasing at a dramatic rate. Full-scale remediation activities are normally supported by developmental feasibility/treatability testing. Government regulators and managers of funding programs, such as Environment Canada's

Contaminated Sediments Treatment Technologies Program (CoSTTeP), National Contaminated Sites Remediation Program (NCSRP), and Development and Demonstration of Site Remedial Technologies Program (DESRT), are frequently required to assess the bioremediation technologies based solely on the results of feasibility/treatability studies which may or may not accurately reflect technology processes. Further difficulty is encountered when two or more technologies are to be directly compared by assessing the outcomes of their respective proponent's treatability studies, which have often been performed using different methodologies. Comparisons between different types of treatability studies are especially difficult when different experimental designs, apparatus, analytical procedures, study duration, statistical analyses, or reporting formats have been used.

The Wastewater Technology Centre has begun to develop a protocol for performing bioremediation feasibility/treatability studies. The protocol endeavors to provide a standardized, scientifically defensible, methodological procedure, for use by technology vendors, researchers, and regulators to effectively evaluate the efficacy and applicability of current and emerging soil bioremediation technologies.

The protocol development includes expert input by academics, government

regulators, and technology vendors. Results of a survey of feasibility/treatability methodologies used by bioremediation researchers and vendors were compiled and a list of the minimum criteria for performing studies was created.

A bench-scale bioremediation treatability study that uses the protocol methodology rather than a selected vendor's treatability methodology is planned to determine the suitability of the protocol. As well, evaluation of the protocol includes a comparative assessment of the costs incurred for different sample numbers, analyses, and labour, versus the quality of the data collected.

A final component of the project is a "vendor selection criteria" document that provides regulators, project managers, scientists, and engineers with a uniform means of objectively assessing vendor proposals that have used treatability studies.

The protocol will provide the guidance on performing feasibility/treatability studies that does not presently exist within Canadian regulatory jurisdictions.

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3rd Annual Symposium on Groundwater and Soil Remediation

The Third Annual Symposium on Groundwater and Soil Remediation was held September 8 to 10, 1993 in Quebec City. More than 400 people attended this annual meeting which had close to 50 technical presentations and 25 displays. This exceptional participation, 50% more than the previous year, indicates that environmental protection has become a key element in the Canadian economy.

Pierre-H. Vincent, former federal Minister of the Environment, kicked off the Symposium. In the context of the Green Plan initiated in Ottawa in December 1990, the Minister reiterated the commitment of his government to support environmental firms in attaining sustainable development. The Minister stated that, by the year 2000, the annual revenue produced by environmental industries will be 12 billion dollars, which represents thousands of jobs.

The Symposium was sponsored by several organizations: GASReP, Environment Canada, the St. Lawrence Centre, the National Research Council of Canada, the Biotechnology Research Institute, the Ministry of the Environment of

Quebec, and the BIOQUAL Network.

The theme of the scientific and technical presentations was the results of studies on technologies used for soil remediation. Most of the results presented had been financed, in part, by the sponsors of the Symposium, for example, Environment Canada's DESRT program.

BIOQUAL's participation in and contribution to the Symposium was well received with nine speakers from the BIOQUAL Network presenting their work.

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Videos on Aquatic Toxicity Testing

Two videos have been prepared to complement Environment Canada's biological test methods for testing aquatic toxicity. The 45-minute video on rainbow trout shows holding and acclimation facilities; sample collection and preparation; a single concentration test; and the LC50s of effluent and reference toxicants. The 35-minute video on *Daphnia magna* describes how to culture *Daphnia*, including food preparation; effluent sampling and transport; as well as testing with effluent and reference toxicants.

Both videos can be purchased from:

The Canadian Association on Water Quality, c/o Environment Canada,
425 St. Joseph Blvd., 4th Floor,
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BIOQUAL teams up with WEAO for its 1994 Symposium

In view of the success in joining with GASREP for its 1993 symposium, BIOQUAL has teamed up with another environmental organization for its 1994 symposium. The next BIOQUAL symposium will be held in conjunction with the 1994 Annual Conference of the Water Environment Association of Ontario (formerly Pollution Control Association of Ontario).

The Water Environment Association of Ontario (WEAO) is dedicated to the transfer of information and concepts about the water environment. The

upcoming Conference will be held April 17 to 19, 1994 in Windsor, Ontario. A call for papers relating to the BIOQUAL portion of the Conference will be issued shortly.

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Conferences

**June 16-17, 1994
Toronto, Ontario**

14th International Symposium on Environmental Pollution and Water Quality and the 18th International Conference on Analytical Chemistry and Applied Chromatography/ Spectroscopy

and

**November 10-11, 1994
New Delhi, India**

17th International Conference on Chemistry, Bio-Sciences, and Environmental Pollution.

Topics: Analytical/inorganic and organic chemistry, chemical engineering, biochemistry/ biosciences and biotechnology, chromatography/ spectroscopy, environmental studies (environmental pollution, aquatic and atmospheric environment, hydrology, water and air quality, etc.), metal analysis, polymers, pyrolysis and thermal analysis, and soil, agriculture, and forestry.

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