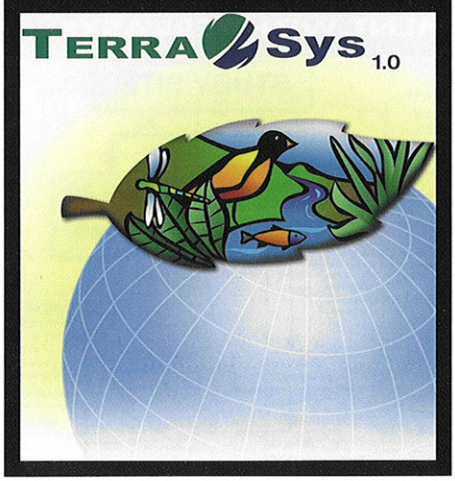
ENVIRONMENT
Site Rehabilitation

ABSTRACT

To assist in the ecotoxicological risk assessment of contaminated sites, Sanexen Environmental Services Inc. has developed a software program called TerraSys. This program integrates various databases and numerous mathematical models. By doing so, the software can evaluate exposure levels of the fauna and flora on a study site based on contaminant concentrations. It can also estimate the risks biological receptors are exposed to.

In addition to substantially reducing the time and costs associated with risk assessments, this software increases the validity and quality of results. It also prioritises planned interventions and avoids excavation and elimination costs when calculated risks are minimal. Thus, TerraSys facilitates the redevelopment of former industrial contaminated sites.

A NEW TOOL FOR ECOTOXICOLOGICAL RISK ASSESSMENT OF CONTAMINATED SITES: THE TERRASYS SOFTWARE



SANEXEN
ENVIRONMENTAL SERVICES INC.

MAIN FEATURES

Technology
- Allows a quick and scientific evaluation of the threat pollutants may represent to the surrounding environment
- Enhances the power of analysis by increasing the level of detail, validity and quality of the results
- Standardises the determination and presentation of risk analysis results
- Adapts easily to the requirements of different governmental organisations

Environment
- Facilitates the redevelopment of sites on which contamination is not a real risk to the ecosystem
- Applies to freshwater and air pollution as well as to contamination in soil
- Identifies the optimal solution

Economy
- Reduces by approximately 50% the time traditionally associated with ecotoxicological risk assessments
- Optimises interventions according to the estimated risks for each particular situation
- Prioritises planned interventions

CEMRS Centre d'excellence de Montréal en réhabilitation de sites
MCEBR Montréal Centre of Excellence in Brownfields Rehabilitation
Canada
Environnement Québec
BRI NRC·CNRC Biotechnology Research Institute
COREM

PROJECT OBJECTIVES/ PHASES

Sanexen Environmental Services' project aimed at developing a software program capable of systematically evaluating ecotoxicological risks on a contaminated site.

Specifically, the project's objective was the development of different software functions, including the following:

- Soil contaminant concentration mapping;
- A user-friendly interface that rapidly generates a graphic of the ecosystem and considers all the variables required in risk assessment;
- Simulations of contaminant transfers into the environment and estimates of concentration levels in different environmental compartments;
- Mathematical modeling of the exposure levels of different receptors: direct exposure (ingestion, inhalation, direct contact) and indirect exposure (food chain);
- Estimation of risks;
- Entry, treatment and evaluation of biotest results.

BACKGROUND

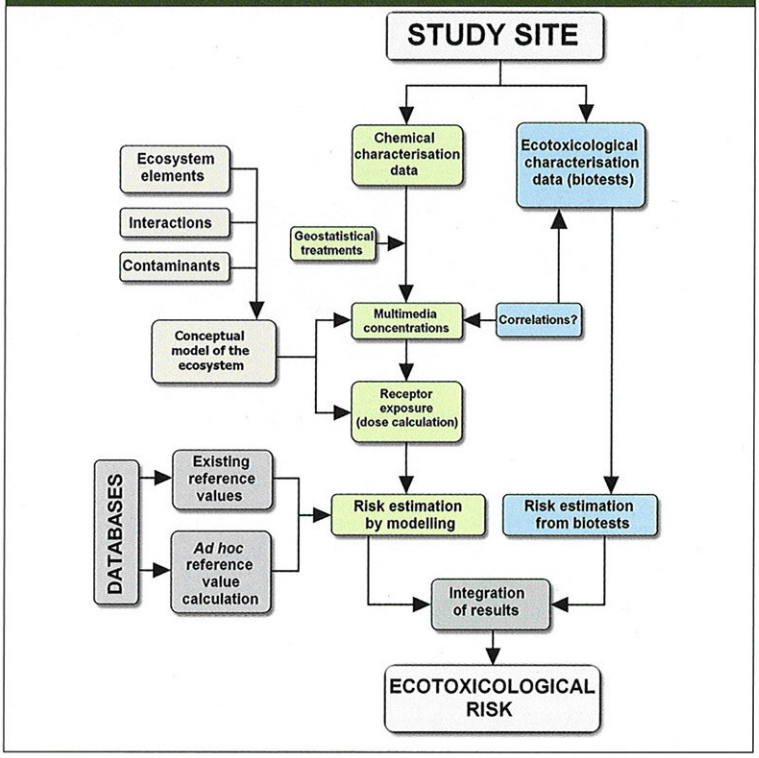
In Quebec, like elsewhere in the world, the contamination of former industrial sites constitutes a serious environmental problem. The toxic substances present on a site pose health risks to the site's future users and can have an important impact on the fauna and flora.

In certain situations, decontamination strategies cannot be based on generic criteria. An analysis of the risks that contaminants may present to the environment becomes necessary. In industrial countries, environmental regulations now require that these risks be taken into account in site protection and rehabilitation (for example, in Québec, Bill 72 of The Environment Quality Act).

Ecotoxicological risks, along with human risks, must now be evaluated within the framework of these regulations.

Ecotoxicological risk assessment is a complex process, particularly because of the various types of receptors it is aimed at (animals, microorganisms, vegetation, etc.). Though there are many publications designed to facilitate the ecotoxicological risk assessment of contaminated sites, the complexity of the required analyses generally demands the elaboration of an algorithm, and, therefore, automated execution of computations. Until recently, no tool was available to systematically evaluate risks to the fauna and flora.

GENERAL PROCESS OF A RISK ASSESSMENT WITH TERRASYS



TECHNOLOGY

TerraSys, the software developed by Sanexen is made up of different well-researched and recognized mathematical models. These models, along with an elaborate algorithm, estimate the concentration levels of contaminants in different areas of the site, as well as evaluate the degree to which the fauna and flora have been exposed. The software also integrates several databases that can be continuously updated. Together, they provide the information required in the ecotoxicological risk assessment of a contaminated site. The software can thus approximate the risks to which the site's different biological receptors are exposed.

For users who wish to carry the analysis further by conducting laboratory biotests on site soil samples, the software also offers entry, treatment and analysis functions that integrate results into the computation of the risk index. The software also includes a contaminant mapping function (for measured or simulated concentrations).

RESULTS

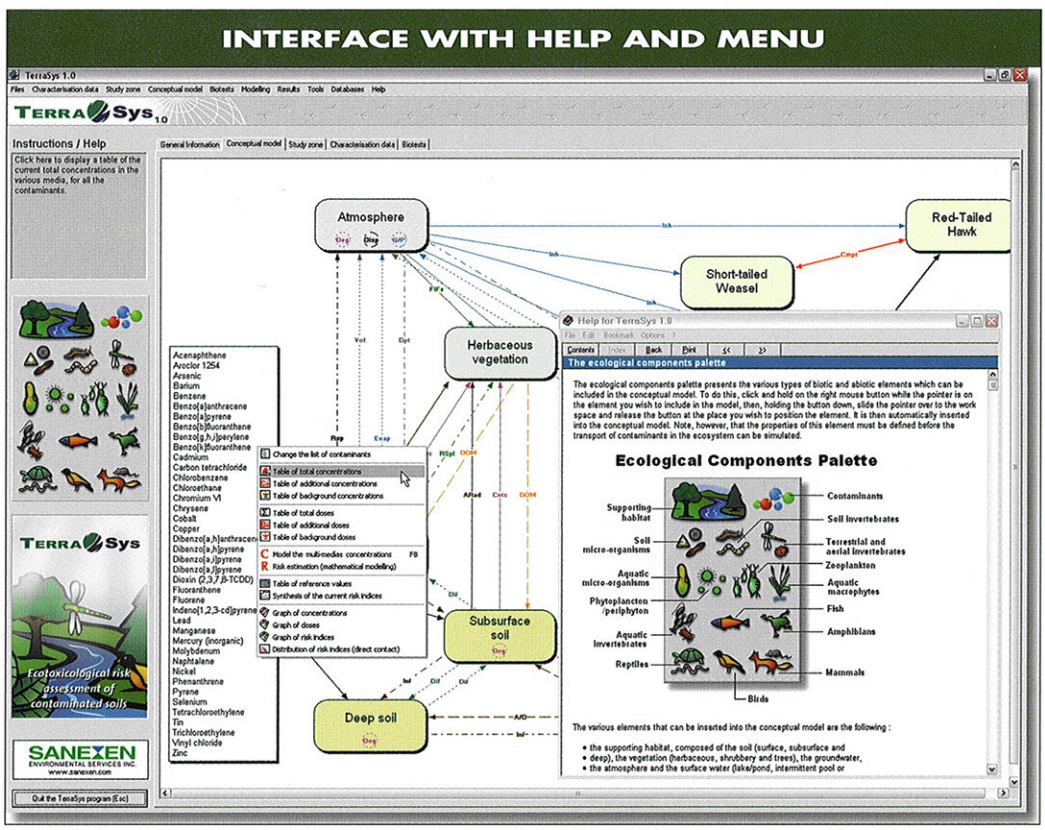
TerraSys rapidly and scientifically evaluates whether on-site pollutants constitute a risk to the fauna and flora.

To this effect, the software's functions were conceived in such a way as to enhance the performance of the different tasks in ecotoxicological risk assessments. For this reason, the software will become a precious tool for professionals in the field of environmental risk assessment. Industrial corporations or those who manage brownfields and who must make the best possible decisions regarding decontamination will find TerraSys to be an excellent analytical tool.

The software is also very beneficial to regulatory agencies involved in environmental protection and management. TerraSys can be a fundamental tool in defining and adopting policies, in developing environmental quality criteria and standards or in evaluating specific cases.

In addition, the software is also a valuable pedagogical tool. By integrating all the steps in the ecotoxicological risk assessment process, Terrasys is an efficient way for students to successfully assimilate field-specific scientific and technical notions. Universities that specialise in environmental studies consider the software to be particularly effective.

Finally, it is important to emphasize that although it was initially developed for cases involving contaminated soil, the software also applies to freshwater and air pollution. TerraSys also offers tools dedicated specifically to the analysis of contaminants or receptors for which no reference values are currently available. Risk assessment is thus considerably enhanced.



POTENTIAL AND LIMITATIONS

Potential

By reducing data processing time, TerraSys allows consultants to lessen by approximately 50% ecotoxicological risk assessment execution time, thereby also reducing their costs. The software not only saves time and money, it also assures the achievement of the most complete, highest quality assessments possible. It effectively increases the level of detail in risk assessments and the validity and quality of results.

In many cases, risk analysis helps administrators realise considerable savings while avoiding decontamination costs on sites for which only a minimal risk is calculated. For example, the execution costs of measures suggested by a risk assessment could be 80% less than the costs of complete excavation and elimination of contaminated soil. In this way, TerraSys favours the redevelopment of former industrial sites by offering, in certain cases, an economical alternative to the application of generic criteria. In addition, the software will prioritise planned interventions.

Limitations

Though the software performs risk assessment on contaminated soil, air and water, its applications in aquatic habitats are limited to freshwater, thus excluding both marine and estuarine ecosystems.

INFORMATION

This technology data sheet is based on the results of studies conducted by Sanexen Environmental Services Inc., in collaboration with the Montréal Centre for Excellence in Brownfields Rehabilitation (MCEBR). The project received the support of COREM and the Biotechnology Research Institute. It was carried out with the financial support of the MCEBR and the FPGST (E) of the ministère de l'Environnement du Québec.

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ENVIRONMENT
Site Rehabilitation

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