



BIOSPHERE



## The Biosphère in Brief

Canada's first Ecowatch Centre, the Biosphère in Montreal, opened in 1995. It is devoted to increasing knowledge of the environment, water and ecosystems, in particular those of the St. Lawrence River and the Great Lakes. It also strives to make visitors aware of the importance of these valuable resources. The Biosphère's mission is to encourage people to take action in favour of water, its protection and wise use.

The Biosphère has many tools to carry out this mission:

### Exhibition Halls

The Biosphère has four large thematic rooms with a total area of 1,134 square metres (12,203 square feet). Each one focuses on a specific aspect of water and teaches visitors about the state of the environment today, water's close relationship with all living things, and ecological issues. Whether introducing visitors to the abundance of ecosystems, shipping and pleasure boating, recreational activities or other water-related topics, the Biosphère's exhibits are designed to be both fun and educational.

### Educational Activities

The Biosphère offers a wide variety of educational and recreational activities suited to the interests and needs of its various clients: educational workshops that fit in with school curricula, school recreational activities, Biosphère Ecowatch Network activities, and specific training sessions on request.

### The Biosphère Ecowatch Network

The Ecowatch Network plays an important role at the Biosphère. It showcases the museum's environmental action mission and supplies some of its information. The network is made up of individuals, schools, non-governmental organizations, municipalities and firms involved in conserving water and ecosystems along the St. Lawrence River, the Great Lakes and their tributaries.

### The Architectural Work

The symbol of Expo 67, the sphere designed by visionary architect Buckminster Fuller has an important place in the history of contemporary architecture. The largest building of its kind in the world, its structure reproduces more than 75% of a sphere.

### Related Services

The Biosphère also offers visitors and the general public a wide variety of services, including group tours for all ages, room rentals for various activities, a documentation centre and a very comprehensive Internet site.



## How to Reach Us

There is a specific fact sheet for each of the Biosphère's activities. They are available on request or can be found on our Internet site. You can reach us at:

160 Chemin Tour de l'Isle, St. Helen's Island  
Montreal, Quebec Canada H3C 4G8

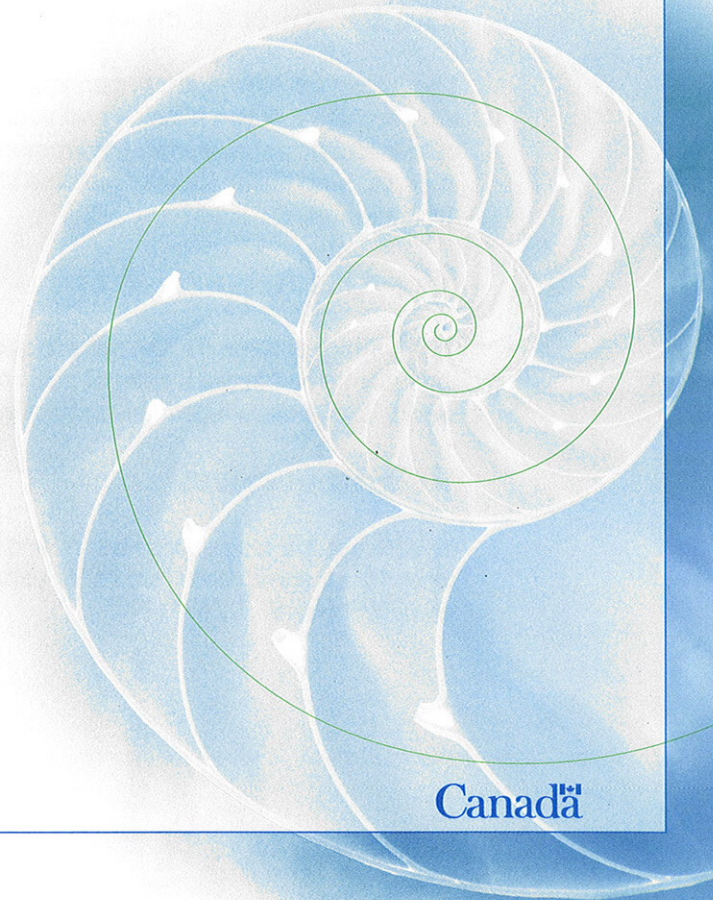
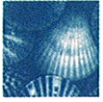
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## The Brief History of a Great Sphere

### 1964

St. Helen's Island was enlarged and Ile Notre Dame was created next to it in a shallow spot in the St. Lawrence. The islands became the site of the 1967 World's Fair.

The same year, the United States Information Agency asked R Buckminster Fuller to submit an architectural plan for the country's Expo 67 pavilion. The idea for the Biosphère arose from the visionary architect's creative imagination.

### 1967

As the United States pavilion, the Biosphère was one of the biggest attractions at the fair. On July 20, the US government officially donated its pavilion to the City of Montreal, which took official possession on January 31, 1968 at 11:59 pm.

For several years after the World's Fair, the Biosphère was used for recreational activities and as a public attraction. For example, its steel frame and acrylic skin protected a unique oasis of plants and birds.

### 1976

In May, while the building's structure was being repaired, a fire destroyed the Biosphère's outer covering. The transparent acrylic skin was never replaced, although the architect, R Buckminster Fuller, did suggest a way to do so. The City of Montreal was forced to ban access to the site.

### 1990

The Parc des Iles management plan was approved. Environment Canada decided to participate in this municipal action plan, which was structured around the site's dominant natural feature: water.

In August, the City of Montreal asked Martoni, Cyr and Associates to examine the state of conservation of the Biosphère and assess the feasibility of restoring its interior structures to their original state. They concluded that, overall, the interior structures had stood up relatively well over time, although major repairs would still be required.

### 1991

On August 9, Environment Canada signed a CDN\$17.5 million agreement with the City of Montreal to convert the Biosphère into a sight devoted to showcasing, observing and studying water and the Great Lakes-St Lawrence ecosystem and to ecoaction. Under the agreement, Environment Canada agreed to assume responsibility for the project's mission and direction and the building's museological content and operation for a 25-year period.



## 1992

Montreal celebrates its 350th anniversary. The development of Parc des Îles was partly completed. The park is 268 hectares in area, making it the largest green space in the metropolitan area after Mount Royal Park. The Biosphère became one of the focal points in the park. The other major centre of activity on the islands is the casino on Île Notre Dame.

Following a competition, Montreal architect Éric Gauthier was commissioned to redevelop the Biosphère's interior structure in keeping with the original design.

## 1994

Work on the new Biosphère was progressing well. The announcement of the Biosphère's new role was made on November 14.

## June 1995

The Biosphère was officially opened on June 5.

## How to Reach Us

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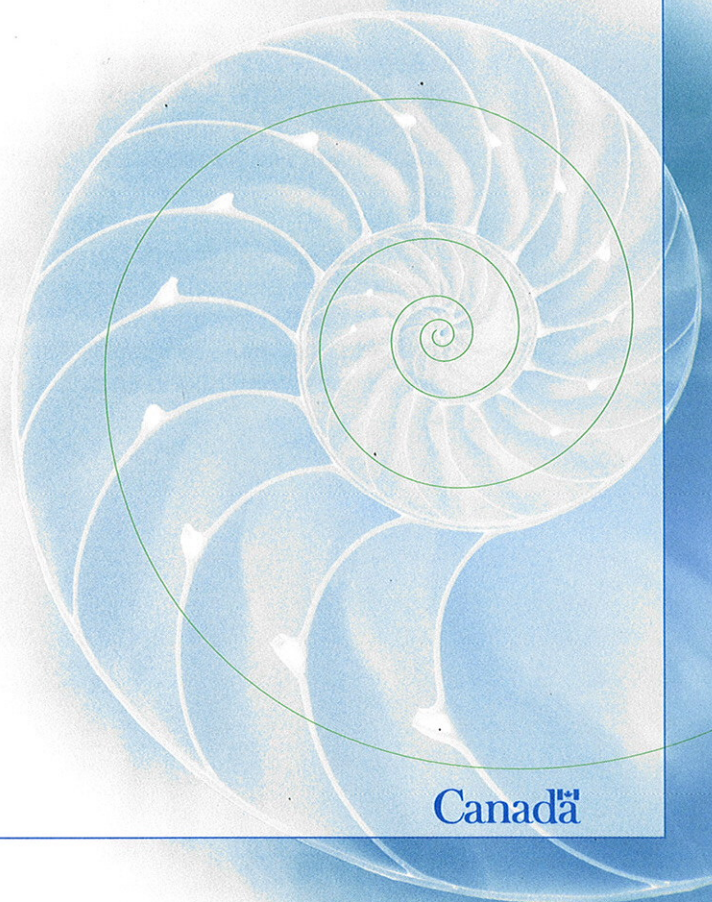
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## The Biosphère's Building Energy Efficiency and Sustainable Development

According to the Biosphère's creator, Buckminster Fuller, humankind cannot long survive if it does not learn to manage its natural resources and energy more efficiently. The result of close co-operation between Environment Canada and the City of Montreal, the Biosphère corresponds to the ecological vision of the great architect and is a concrete example of sustainable development principles.

Sustainable development advocates development that meets today's needs without compromising the capacity of future generations to satisfy their own needs.

In redeveloping the Biosphère, consideration was given to the preservation of a building that is part of Montreal's heritage, and to the conservation of every element that could be recovered. The architectural plan hinged on repairing elements that had deteriorated over time and on creating a new layout within the existing structure.

In keeping with the principles of sustainable development, the Biosphère has implemented an efficient energy savings program that saves considerably on the annual heating and electricity bill. The construction and layout of the Biosphère make use of the latest energy-saving innovations and energy-efficient materials.

The Biosphère's facilities have a computerized control system to optimize energy use.

- For lighting, the Biosphère uses compact fluorescents that, while providing the same amount of light, use less than half the amount of energy of ordinary incandescent lights.
- All motors used in the Biosphère are high-performance, that is, they provide the same degree of effectiveness while using less energy.
- The Biosphère's ventilation system uses hot-air recovery coils. In mid-winter, heat from air vented to the outside is recovered and transferred to air entering the building. In summer it is the opposite.
- A load monitoring system limits electricity consumption during peak periods. The system automatically manages the building's main operations in accordance with the resources available.
- Heating at the Biosphère is largely based on the geothermic principle (that is, heat recovery). Its originality lies in its heat pump, which is able to draw groundwater from 91.4 metres (300 feet) below the surface. Under the earth, water remains at a temperature of 11° Celsius (52° Fahrenheit). It is pumped to the surface, where heat is extracted, and then returned underground. 45 heat pumps disseminated in the building can heat or air condition the building by extracting heat from, or shedding it into, the groundwater. Compared to conventional systems, the system has almost no impact on the environment.



## Wastewater Management

An ingenious wastewater treatment system using artificial marshes filled with aquatic plants has been laid out near the building. Designed by the plant biology institute at the Montreal Botanical Garden, the system consists of a series of three ponds containing plants that grow in water and wetlands. The main plants used are *Phragmites communis*, *Scirpus lacustris*, *Typha latifolia*, *Iris versicolor*, *Mentha aquatica* and *Elodea canadensis*.

The system is inexpensive to build and operate and is as reliable and effective as other water treatment systems. The Biosphère has become a reference centre for sustainable development and alternative, environmentally friendly technology.

Using leading-edge technology, the Biosphère has set itself the task of conserving energy and preserving resources.

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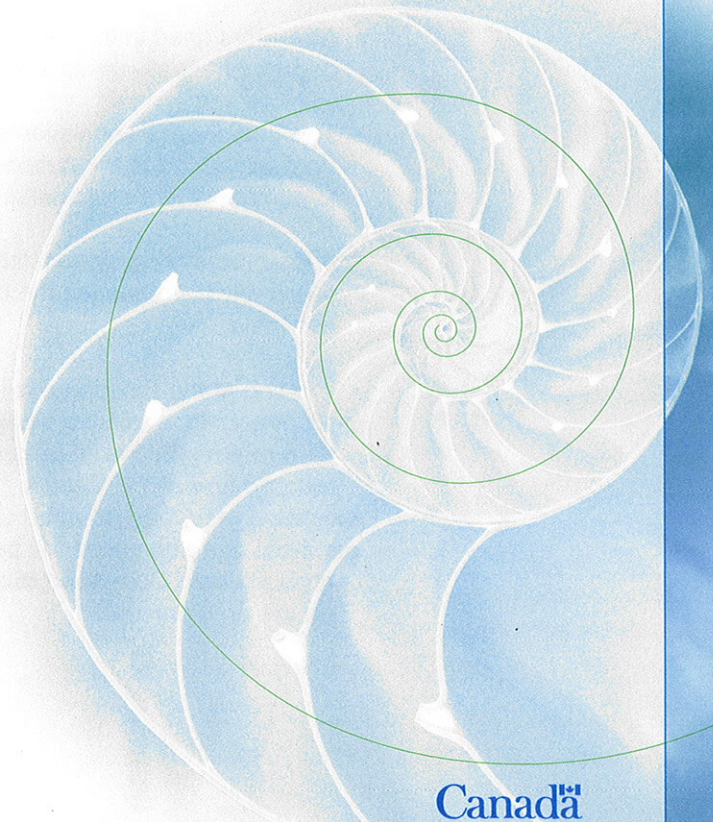
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## The Ecoaction Room

The Biosphère's Ecoaction Room (EAR) is both a documentation centre and an exhibition hall. Visitors come to look for literature on a specific aspect of the St Lawrence-Great Lakes ecosystem, record their opinions, make a commitment to help the environment or join the Biosphère's Ecowatch Network.

The EAR is also the repository for data on the state of the ecosystem collected by members of the Ecowatch Network.

Its facilities include:

- A specialized reference centre on subjects related to the Biosphère's mission.
- Works of all kinds (books and other printed materials, CD-ROMs, audio cassettes, photographs, slides, videos, maps, etc.) with water-related themes, the St Lawrence-Great Lakes ecosystem, Canada's river ecosystems, the St Lawrence Seaway, the Biosphère's Ecowatch Network and environmental action.

The Ecoaction Room is open Tuesday to Sunday from 10 am to 5 pm.

## How to Reach Us

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## **Buckminster Fuller a Visionary Architect**

The self-taught inventor-engineer and architect R. Buckminster Fuller (1895-1983) was a thinker ahead of his time. His ideas may be summarized as doing the maximum with a minimum amount of energy and raw materials, and striving for maximum efficiency with minimum output.

Fuller wrote that the goal of his research was to view the universe as an organization of regenerative principles. This is the very basis of life, with references to rebirth, reproduction and, in architectural language, to the notions of space, cycles, orbits and cells. His ideas found their expression in forms such as the egg, ball, sphere and geodesic dome. Built from triangles, which he considered the perfect form, Montreal's Biosphère is the synthesis of his entire creative process.

The triangle is a natural mathematical figure that, in combination with other triangles, provides maximum efficiency with minimum structural effort. By assembling a series of identical geometrical units that are both self-supporting and light, Fuller obtained a dynamic construction in which the individual components contribute to the overall structure. While each component is independent, it cannot exist without the others. With his biosphère, Fuller demonstrated that it was possible to create a liveable space using only one-fiftieth of the materials normally used in a conventional architectural design.

An avant-garde ecological visionary, Fuller believed that we should learn to manage the planet differently, in a way more respectful of the fundamental balance of our ecosystems. In terms of architecture, this philosophy meant less demanding construction using a minimum amount of materials while freeing up a maximum amount of space.

Long before society was concerned with a global vision and environmental protection, Fuller spoke of interrelationships, synergy and integrated functions, stating that the world was the sum of all human experience, an accumulation of each person's experience. The parallel with Oriental philosophies is striking. Seen from this point of view, the mystical character of Fuller's approach becomes clear.

He wondered how we could make the best use of our technology while improving humanity. Already in the early 1960s, Fuller predicted that the survival of humankind would be compromised unless we stopped wasting the earth's natural resources.

This way of thinking—global and ecological before those terms had been coined—inspired Environment Canada and the City of Montreal to set up the Biosphère. Its restoration and development have given the original structure a mission perfectly in line with the American architect's vision.

In 1968, the US pavilion received a Design Award from the American Institute of Architects. The jury compared the spatial effect of the platforms, which seemed to float in the air, to a weightless sensation, entirely in keeping with the experiences of the first flights into space. The interior was skilfully integrated with the sphere's frame. The architectural quality of the building resides not only in the technical feat of the structure, but also in the link between the frame and its contents.



Right from its construction, this building was recognized as an important expression of Buckminster Fuller's visionary research, and is still recognized as such today.

In 1976, a fire destroyed the Biosphère's outer covering. Two years later, Fuller proposed replacing the acrylic panels with new fireproof panels made of fibreglass and coated with Teflon. The costs of restoring the Biosphère were such that, in the end, it was decided to preserve the tubular structure and develop a new building inside, a little like a ship in a bottle.



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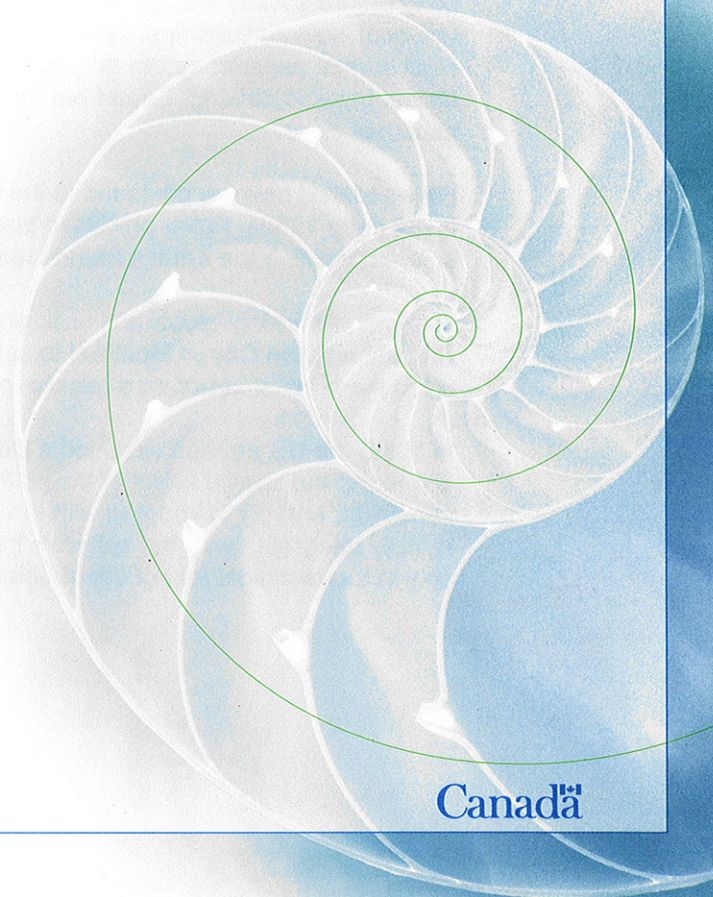
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## A Futuristic Architecture The Original Building

The symbol of Expo 67, Buckminster Fuller's sphere is a landmark in the history of contemporary architecture and the most important building of its kind in the world. Its structure reproduces more than 97% of a sphere. In 1964, the United States Information Agency asked Fuller to submit an architectural plan for the US pavilion at Expo 67.

This enormous ball is 62.8 metres (206 feet) in height, 76.2 metres (250 feet) in diameter and has a volume of 189,724 cubic metres (1,700,000 cubic feet). Its trellis-like frame is made up of steel tubes welded at each end to steel joints. The structure's total weight is 600 tonnes. The structure consists of two spheres, one inside the other, with about one metre between them. The outer sphere is made up of triangles with 2.4-metre (8-foot) sides while the inner sphere consists of hexagons with 1.5-metre (5-foot) sides. The two frames are connected to each other by steel tubes welded at their joints. The resulting nodes support ten tubes on the outer joints and six tubes on the inner joints. The entire structure is a multitude of tetrahedrons with each component attaining maximum efficiency.

The original structure was covered with 1,900 transparent acrylic panels. A system of motors driven by solar energy controlled the interior temperature. The building's complete transparency created an almost invisible barrier between the inside and the outside. In 1976, while the structure was being repaired, a fire broke out and completely destroyed the acrylic skin. Only the tubular frame remained intact.

The outer shell of the Biosphère was awarded to Buckminster Fuller, but the design of the US pavilion's inner structure was given to Cambridge Seven Associates Inc, a group of Harvard University architecture and design professors. The original building thus has two signatures.

The original inner structure consisted of four large platforms divided into seven levels and connected by escalators, bridges and elevators. During Expo 67, the gigantic structure included a 37.5-metre (123-foot) escalator. The longest escalator ever built, it was the equivalent of eight floors. A monorail also crossed the pavilion.

## The Architectural Concept of the New Biosphère

The challenge facing Montreal architect/designer Éric Gauthier, who was commissioned to redevelop the Biosphère, was nothing less than to build a ship in a bottle. Mr Gauthier's plan was selected in an architectural competition held in 1992.

The precepts of sustainable development imply respect for a building's history and the contributions of previous generations. The Biosphère had two signatures: Buckminster Fuller for the outer shell (the Biosphère itself) and Cambridge Seven Associates for the inner structure. It was known around the world and was part of Montreal's architectural heritage. Its survival and the preservation of its unique character were absolutely essential.

The architectural plan selected reflects the Biosphère's needs. The space has been organized to maximize the amount of natural light and living contact with the sphere. The Biosphère's original character lies in the transparency between inside and outside.



In addition, the new space, which is 4,000 square metres (43,000 square feet), had to take into account the Biosphère's public mission. It would be laid out like a ship and be in constant contact with water, its theme. The building's three floors would serve an essentially marine function, corresponding to a ship's hold, bridge and crew's nest.

Since the blue planet, Earth, is made up mainly of water, the Biosphère is reflected in an outdoor pond. On the inside, a water garden lends the building a meditative note.

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