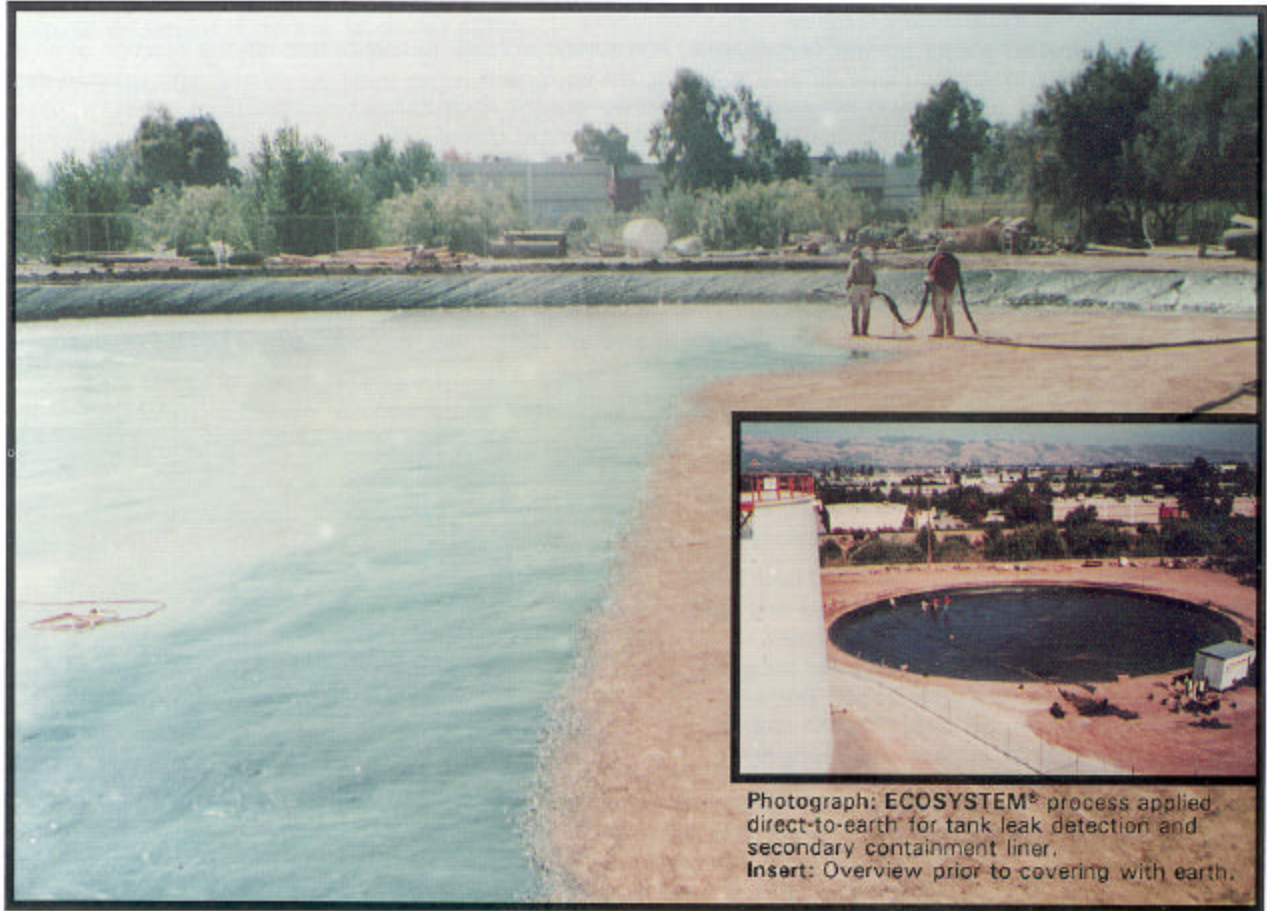


ECOSYSTEM®

A NEW **DIMENSION** OF MATERIALS USING SELECTED DENSITY CONTROL
OF CHEMICALLY CROSSLINKING COMPONENTS BY PHYSICAL EXPANSION
U.S. PATENT NUMBER 4,590,218



Photograph: ECOSYSTEM® process applied direct-to-earth for tank leak detection and secondary containment liner.
Insert: Overview prior to covering with earth.

THE **ECOSYSTEM**® PROCESS OFFERS NEW METHODS AND MATERIALS FOR AN ENVIRONMENTALLY SENSITIVE WORLD

- * New dimensions for coatings
- * New opportunities for plastic molding materials
- * New uses for chemically reactive plastic formulations
- * Improved engineering properties for plastics
- * Improved insulation materials
- * New alternatives for chemical containment
- * New recycling opportunities

GET

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ECOSYSTEM®

SELECTED DENSITY CONTROL FOR CHEMICALLY REACTED SOLVENT-FREE LIQUID POLYMER COMPONENTS

The patented **ECOSYSTEM®** expansion process adds *NEW DIMENSIONS FOR COATINGS* through versatile and cost effective use of readily available liquid, chemically crosslinking 100 percent solids (with zero Emissions) materials.

The **ECOSYSTEM®** process allows for *NEW OPPORTUNITIES FOR PLASTIC MOLDING MATERIALS* through the injection of an inert gas into the stream of crosslinking materials prior to exiting the equipment (spray gun/pour nozzle) with selected density control. This process creates *NEW USES FOR CHEMICALLY REACTIVE PLASTIC FORMULATIONS* by developing materials that can be deposited into a mold or onto a surface in a non-stressed, expanded closed cell, light weight, seamless monolithic condition. This process does not change chemical resistance or permeability characteristics as defined in the non-expanded solid condition.

ECOSYSTEM® provides *IMPROVED ENGINEERING PROPERTIES FOR PLASTICS* by forming a composite structural product having substantially the same chemical composition throughout while offering the ability to provide regions of different densities. The process also allows for the injection of fibers and/or fillers into the stream of expanding and crosslinking materials on an "as needed" basis to improve compressive strength and/or tear resistance of the applied products.

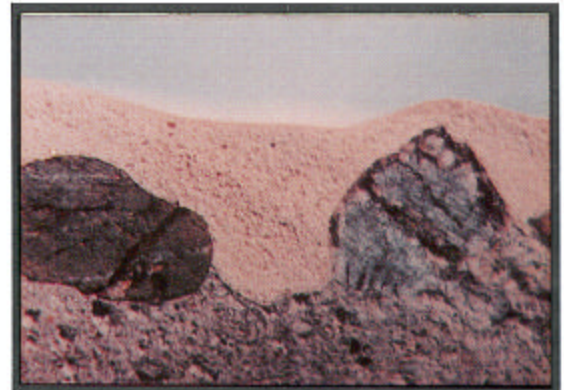
The cellular nature of the expanded materials greatly enhances thermal properties when compared to the same material applied as a solid. This allows for the development of *IMPROVED INSULATION MATERIALS* without sacrificing chemical resistance.

While the **ECOSYSTEM®** expanded materials have the characteristics of foamed products, their flow and spray capabilities remain very similar to standard liquid coatings. This creates *NEW ALTERNATIVES FOR CHEMICAL CONTAINMENT* by allowing for **ECOSYSTEM®** process applications of solventless materials direct-to-earth or on other extremely irregular surfaces as a completely seamless non-stressed lining.

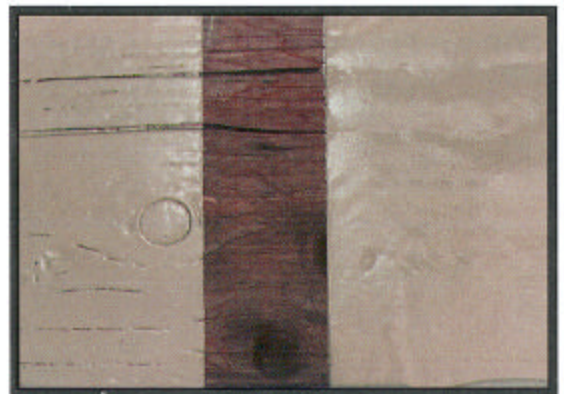
The **ECOSYSTEM®** process creates *NEW RECYCLING OPPORTUNITIES* by allowing for the introduction of recyclable waste products into the applied systems with complete encapsulation. These recyclable waste products may consist of rubber, plastics, glass, and other materials contaminated with hazardous waste solid products such as heavy metals and asbestos.

Due to lighter weight and lower density, the **ECOSYSTEM®** applied products offer high build and hang characteristics unmatched by traditional solid film materials while allowing for reduced raw material costs, elimination of CFC blowing agents, and the integration of filler products into the applied materials.

This phenomenal condition allows for a wide variety of use applications, to include: RIM, RRIM, SRIM, Open Molding, Pulforming, Marine Flotation, Coated Fabrics, Secondary Containment Coatings, Concrete Rehabilitation Coatings, Asphalt Repair Coatings, and Encapsulation of Environmentally Hazardous Materials.



Cross-sectional view of **ECOSYSTEM®** process application of solventless polyurethane applied over severely degraded concrete.



See the difference. Left side - 20 mils of 100% solids polyurethane applied over cracked wood. Right side - 20 mils of same material expanded three times using **ECOSYSTEM®** process.

APPLICATIONS DIRECT-TO-EARTH

The patented *ECOSYSTEM*® expansion process has been successfully used for secondary containment, embankment stabilization, and pond liners/drainage systems with applications of solventless polyurethane material applied direct-to-earth. The *ECOSYSTEM*® expansion process allows the applicator to inject a pressurized inert gas into the stream of chemically crosslinking materials prior to the materials exiting the spray gun. This results in a non-stressed, expanded closed cell, lightweight, seamless monolithic film without changing chemical resistance or permeability characteristics of the material as defined in the non-expanded condition.

The *ECOSYSTEM*® expansion process allows for the use of the 100 percent solids materials in areas that were previously impractical. As an example, direct-to-earth spray applications (secondary containment) of expanded material minimize losses of expensive material "soaking in." It provides a completely seamless non-stressed lining over the earthen substrate and tie-in areas at perimeter walls, pipe supports, structural members, and other such objects that have traditionally been problem areas for "sheet goods." Chopped fibers can be added if necessary to the expanded material using known "chopper gun" technology for additional strength where desired.

Due to the non-stressed condition of the applied materials, the *ECOSYSTEM*® expansion process allows for applications over extremely rough surfaces with complete conformability.



ECOSYSTEM® process applied direct-to-earth for secondary containment liner.

CONCRETE REHABILITATION

The patented *ECOSYSTEM*® expansion process has been successfully used for rehabilitation of severely deteriorated concrete in waste water treatment, hazardous materials containment, and manhole entries. The *ECOSYSTEM*® process allows for a more versatile and cost effective use of 100 percent solids, solvent-free materials that are now on the market. As an example, (depending on product) expanding a material three times (i.e., 25 mils of solid expanded to 75 mils) allows the contractor to produce thicker films at reduced material costs (75 mils for the cost of 25 mils). This creates opportunities to effectively compete in markets that were previously unavailable due to the high cost of these materials when applied as solid thick films of 50 mils and up.

Severely deteriorated concrete surfaces showing excessive roughness of exposed aggregate can be smoothed (conforming to substrate) and sealed to a pinhole free condition with the spray applied expanded chemical resistant materials. This eliminates the need for past practices of filling and smoothing these rough surfaces with concrete resurfacers or caulking materials prior to coatings application, which in turn, allows for reduced surface preparation costs and reduced down time.

Due to lighter weight and lower density, the *ECOSYSTEM*® applied products offer high build and hang characteristics unmatched by traditional solid film materials without changing chemical resistance or permeability characteristics as defined in the non-expanded solid condition.



ECOSYSTEM® expanded materials applied direct to severely degraded concrete in sewer treatment clarifier.

ECOSYSTEM®

NEW DIMENSIONS FOR CHEMICALLY REACTED SOLVENT-FREE LIQUID POLYMER COMPONENTS

The Patented *ECOSYSTEM*® Expansion Process gives licensed operators the unique ability to:

- * expand polymer components into lightweight, thick films without changing chemical resistance or permeability.
- * use one material to provide different end products, assuring more efficient use of materials and materials compatibility.
- * coat extremely rough surfaces with expanded materials to a "pinhole free" condition with minimal effort when compared to traditional solid film applications that require smoothing the rough surfaces with fillers such as caulking compounds and concrete resurfacers.
- * offer spray-applied seamless thick films with the ability to inject fibers and/or fillers into the stream of crosslinking expanded materials on an "as needed" basis to increase compressive strength and/or tear resistance.
- * cost effectively compete in secondary containment markets requiring applications direct-to-earth or on other extremely difficult-to-coat surfaces such as deteriorated concrete, asphalt, wood, and metals by offering expanded materials that minimize material losses due to "soaking in," minimize surface preparation requirements, and assure conformability. Stresses arising from installation over irregular surfaces are virtually eliminated with the expansion application process as compared to those inherent with premanufactured "sheet goods" that are made flat and expected to conform to other configurations without induced stresses.
- * offer thicker films at reduced materials cost. As an example, expanding a solid material three times (i.e., 20 mils expanded to 60 mils) allows for thick film applications while reducing materials cost to that approaching thin film coatings.
- * offer solutions to difficult problems by introducing new use concepts for readily available materials with proven track records.



Wood dock secondary containment. Sand/Fiber fillers injected into *ECOSYSTEM*® expanded materials for heavy physical abuse. View 3 hours after application.



ECOSYSTEM® expanded materials applied direct-to-earth for embankment stabilization. Minimal surface preparation required.



Secondary containment for acid products. Sand/fiber fillers injected into *ECOSYSTEM*® expanded materials and applied direct-to-concrete.