



Advanced Contaminant Vapor Barrier Systems

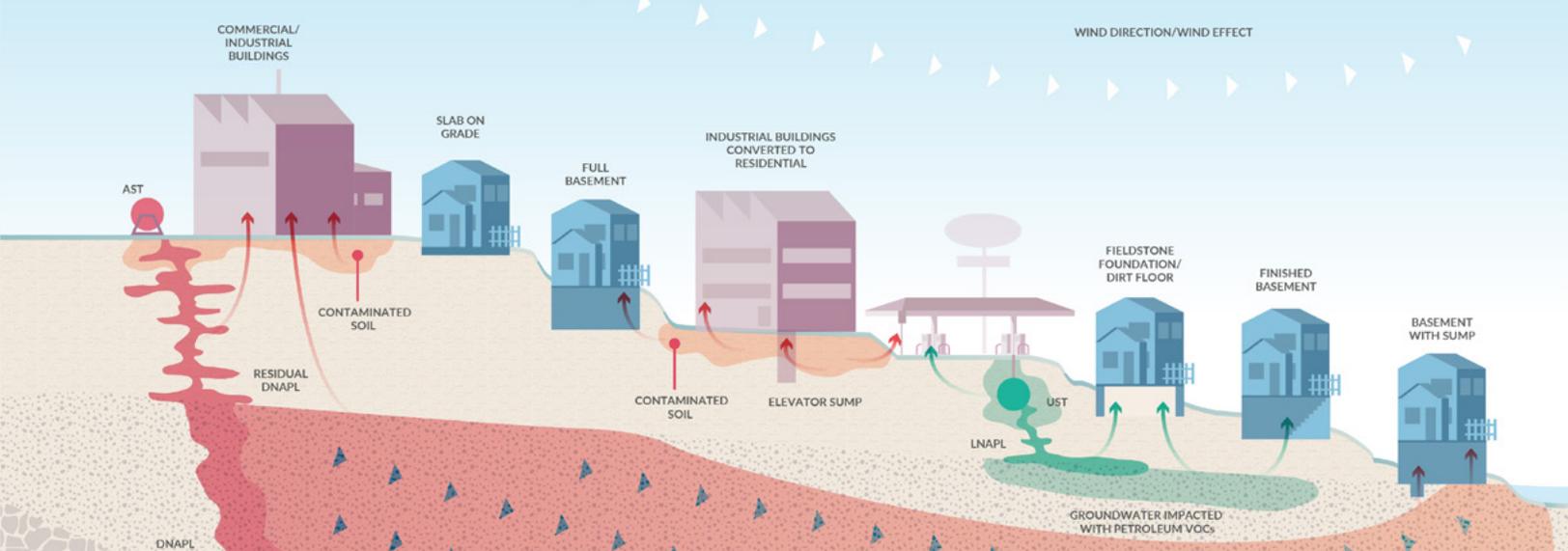
More Protective, More Cost-Effective.



Land Science Vapor Intrusion Solutions

As experts in the field of contaminant vapor intrusion mitigation, Land Science[®] works with leading engineering firms, environmental consultants, building owners, and real estate developers to offer safe and effective contaminant vapor intrusion mitigation solutions in the redevelopment of brownfield sites.

As risk standards and other compliance issues associated with contaminant vapor intrusion continually evolve, engineered controls like those offered by Land Science provide a practical, cost-effective solution to eliminate risks. Recent advances in contaminant vapor intrusion mitigation developed by Land Science have assisted developers, engineering firms, regulators, and land owners by providing technically sound solutions effectively mitigating these issues.



Contaminant Vapor Intrusion Defined

What is contaminant vapor intrusion? Simply stated, contaminant vapor intrusion is the transport of chemical vapors from subsurface soils and/or groundwater into buildings through diffusion and advection due to barometric pressure changes, wind load, thermal currents, or depressurization from building exhaust fans. Contaminant vapor intrusion is highly site specific due to varying natural conditions, contaminants and migration pathways. A few of the common variables affecting contaminant vapor intrusion include: contaminant type (i.e. petroleum compounds or chlorinated solvents), type of soils beneath the structure, contaminant concentration, exposure/contaminant migration pathways (like foundation cracks and utility trenches) depth and location of contaminants relative to the structure, and building ventilation system design.

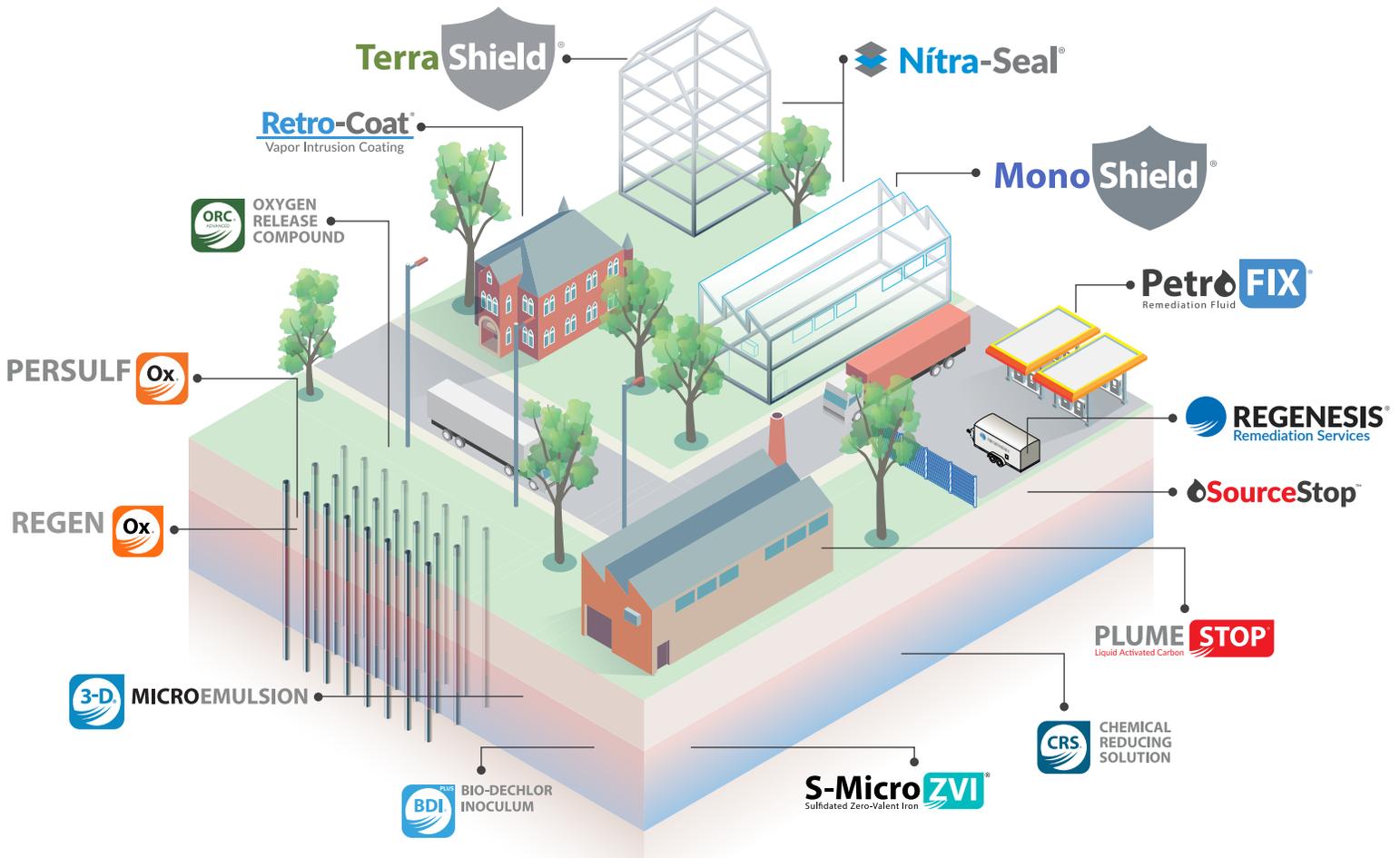
Why is Mitigation of Contaminant Vapor Intrusion Important?

For developers and engineers, successful mitigation of vapor intrusion is paramount to protect human health for regulatory compliance and liability protection. In the past, regulatory closures typically evaluated soil and groundwater exposure pathways, but did not always include evaluation of vapor migration into buildings. As a result, closed regulatory cases in several states have been reopened in order to include evaluation of vapor intrusion, and in many cases, installation of vapor mitigation systems.

In addition, vapor cases are becoming topics of litigation, which could potentially cause property owners or lenders severe monetary and reputational risks. The “end game” is this: due to the fact that many past regulatory closures left contamination in place in soil on a site, many existing developments, even if constructed in the last few years, are being scrutinized for vapor by lenders and regulatory authorities.

Why Mitigate?

- ➔ Protect human health
- ➔ Reduce cost of site remediation
- ➔ Expedite site construction
- ➔ Reduce site investigation and evaluation
- ➔ Protect client's investment
- ➔ Reduce risk and liability
- ➔ New regulatory requirements



Our Solutions

Innovative, Cutting-Edge Approaches
To Vapor Intrusion Mitigation

TerraShield Overview

TerraShield[®] is a significant step forward for contaminant vapor intrusion barriers. Employing an innovative metalized film technology, TerraShield provides superior chemical resistance over any existing vapor barrier currently on the market. It is the ideal vapor mitigation solution for residential, industrial, and commercial developments with volatile contaminant impacts that represent significant health hazards and economic liabilities.

Technology

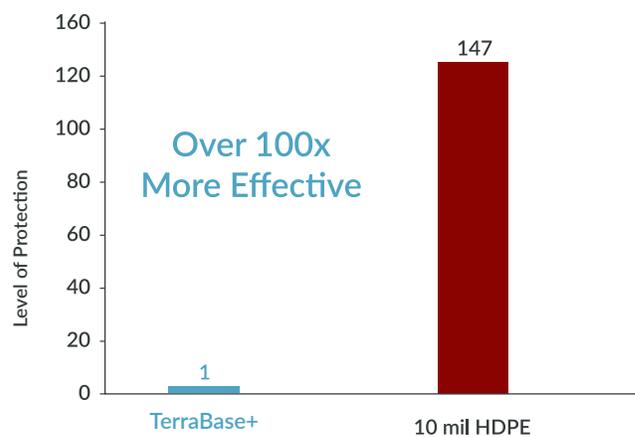
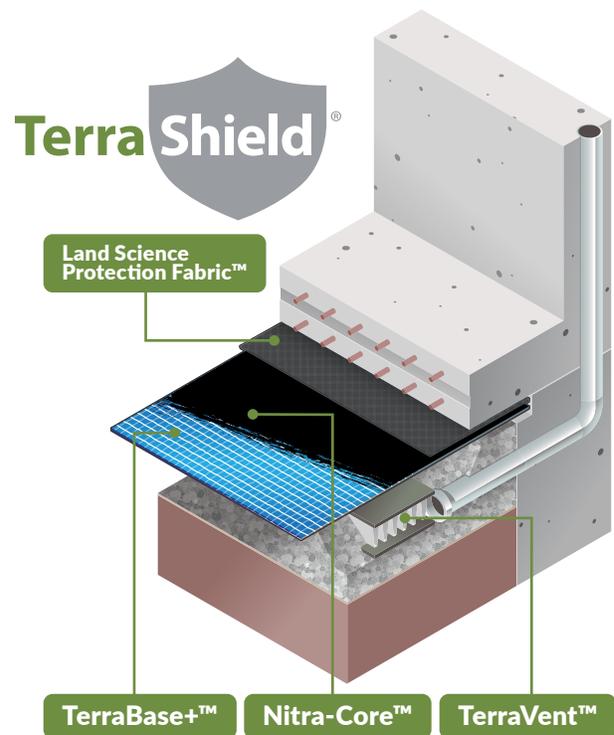
A Multi-Layer Base with Innovative Metalized Film Technology

The Land Science research and development team of scientists have invested years in developing the TerraShield vapor barrier system and advancing the materials commonly used in composite spray-applied barriers. The patented base layer of the system now provides over 100x greater chemical resistance versus a traditional HDPE sheet good, due to the combination of metalized film and polyethylene.

Nitrile-Modified Asphalt Technology

Land Science researchers have developed a breakthrough technology which incorporates nitrile, a material known for enhanced resistivity to contaminant permeation, into the spray applied asphalt core formulation. The resulting nitrile-modified asphalt core component offers an improvement of up to 10x in chemical resistivity compared to generic asphalt-latex spray applied barriers.¹

1. U.S. and international patents pending.



Accelerated comparison showing the relative TCE flux through the vapor barrier base components: TerraBase+, an innovative metalized geomembrane, versus 10 mil HDPE.

Nitrile-Modified Asphalt Compared to Generic Polymer-Modified Asphalt

Nitrile-Modified Asphalt

- ✓ Lab-proven to provide 10x higher chemical resistance
- ✓ Easier and faster to apply
- ✓ Equipment requires only soap and water to clean

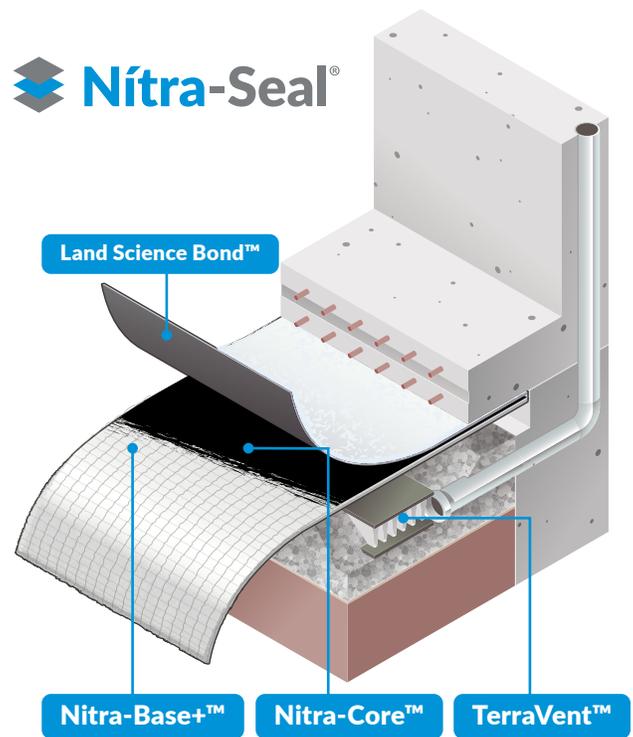
Generic Polymer-Modified Asphalt

- ✗ Higher permeability increases risk of contaminant sorption
- ✗ Longer, slower application time
- ✗ Equipment requires petroleum-based solvents to clean

Nitra-Seal Overview

Nitra-Seal® is a multi-layer contaminant vapor barrier, designed to provide more protection than existing polyethylene-based barrier systems. Originally, passive vapor barrier systems were based on waterproofing systems adapted for use as contaminant vapor barriers. An acknowledged weakness in these systems is in the penetration and perimeter termination locations, where spray-applied core material composed of Styrene-Butadiene (SBR), or other generic polymer-modified asphalt is used. While excellent at repelling water, aggressive chemicals such as petroleum solvents and chlorinated VOCs, will permeate into the SBR-modified asphalt at a relatively high rate particularly in sensitive areas of the building construction such as barrier seams, slab penetrations, and perimeters. Nitra-Seal offers a substantial upgrade as it employs a more chemically resistant nitrile latex instead of the more susceptible SBR material.

Nitra-Seal has been lab-tested and proven to be highly effective against VOCs like chlorinated solvents and petroleum contaminants, and methane. The Nitra-Core component of this system is laboratory tested to be up to 10x more effective than typical spray-applied SBR modified asphalt material.

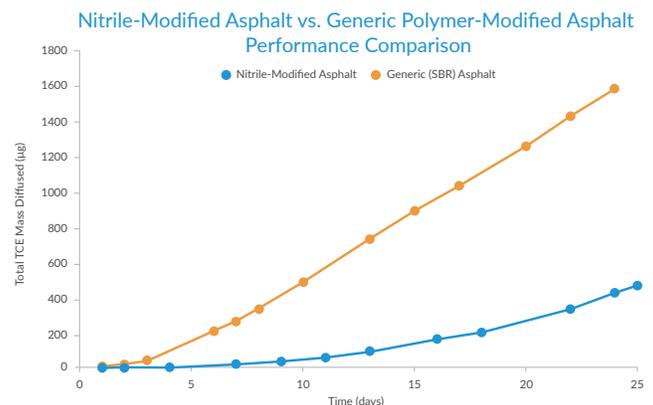


Technology

A Multi-Layer System with Innovative Nitrile-Modified Asphalt Technology

Nitra-Seal is an improvement on current vapor barrier systems, due to the inclusion of the most chemically resistant spray-applied core material available on the market.¹ Nitra-Seal is a triple-layer system comprised of two polyethylene-based layers on the top and bottom, Nitra-Base+ and Land Science Bond, with Nitra-Core spray-applied in the middle.

The Nitra-Base layer (bottom) and the Land Science Bond layer (top) are composed of a polyethylene material bonded to a geo-textile on the out-facing side. Polyethylene is known for chemical resistance, high tensile strength, excellent stress-crack resistance and highly reliable subsurface containment. The geo-textile, which is physically bonded to the chemical resistant layer, accomplishes two goals; it allows the Land Science Bond layer to adhere to the slab, and provides friction course between the Nitra-Base layer and the soil. The Nitra-Core layer is composed of a unique, nitrile-modified asphalt which also provides additional protection against vapor transmission. Nitrile has been proven to offer exceptional chemical resistance in a wide range of applications. This layer creates a highly-effective seal around slab penetrations and eliminates the need for mechanical fastening at termination points.



Accelerated comparison showing relative TCE flux through Nitrile-Modified Asphalt vs. Generic SBR Asphalt

1. U.S. and international patents pending.

MonoShield Overview

MonoShield® is a chemically resistant and easy-to-apply contaminant barrier specifically designed as a preemptive solution for VI at brownfield redevelopment sites. It is backed by unparalleled design support, robust warranty options, and a network of certified applicators who can ensure quality installation.

Technology

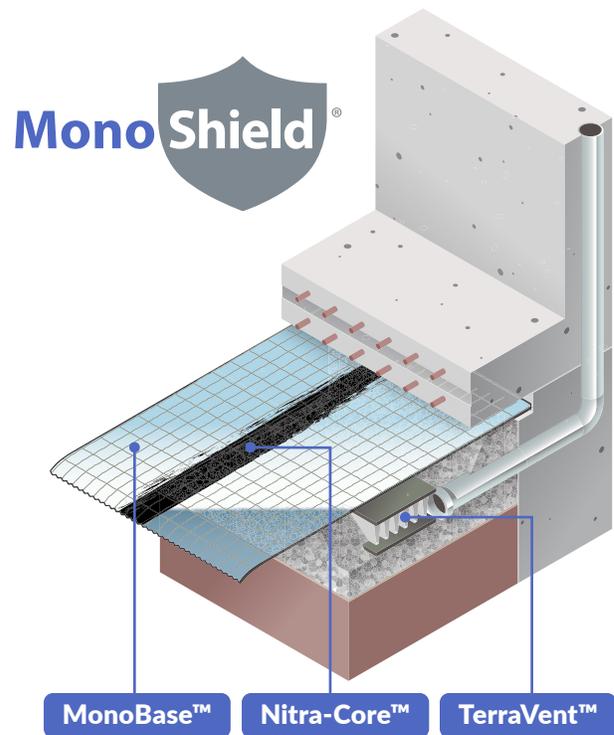
Innovative Metalized Film Technology

Composed of an innovative metalized geomembrane that sets the standard for preventing diffusion and permeation of chemical vapors and a nitrile-modified asphalt that ensures a seal far more effective and easier to apply than tape-based or heat-welded systems, MonoShield offers the best of both worlds, providing developers with a viable long-term solution for reducing liability and protecting human health at a competitive cost.

Nitrile-Modified Asphalt Technology

Land Science researchers have developed a breakthrough technology which incorporates nitrile, a material known for enhanced resistivity to contaminant permeation, into the spray applied asphalt core formulation. The resulting nitrile-modified asphalt core component offers an improvement of up to 10x in chemical resistivity compared to generic asphalt-latex spray applied barriers.¹

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Nitrile-Modified Asphalt Seams vs. Taped Seams



Example of Nitrile-Modified Asphalt Seams

MonoShield applications utilize a spray-applied, nitrile-modified asphalt to seal seams and penetrations, eliminating bottlenecks in performance and installation time.



Example of Taped Seams

Traditional vapor barrier installations require taped seams which contributes to long construction times and uncertainty in performance.

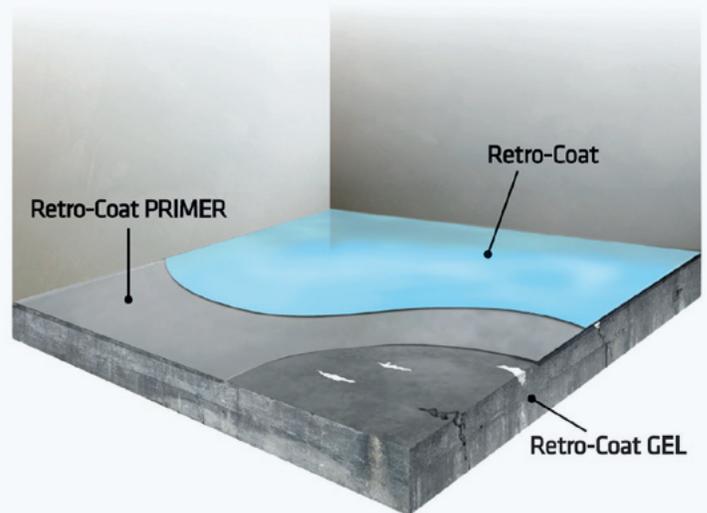


Retro-Coat Overview

The Retro-Coat® Vapor Intrusion Coating System is a chemically resistant coating technology which protects existing structures from the threat of contaminant vapor intrusion. Retro-Coat is installed on top of existing concrete and provides a durable, finished surface eliminating the need for additional concrete protection.

The Retro-Coat system has been subjected to rigorous testing procedures to prove its ability to combat the most aggressive chemical vapors. The system is rated for industrial use suitable for foot and forklift traffic and can be designed to allow vehicular traffic. Retro-Coat coating technology was specifically developed for vapor intrusion protection.

Retro-Coat[®] Vapor Intrusion Coating



Available in a Variety of Finishes



Retro-Coat comes in a standard gray color and finishes to a high-gloss, easy to clean surface. Additional colors and finishes are available. Speak with a Land Science representative today to learn more.



Industrial, Commercial and Residential Solutions

Effectively Mitigating Vapor Intrusion
Across a Variety of Site Types

Chlorinated Solvent Risk Abated Making Way for Future Storage Facility

A Full-Service Moving, Packing and Storage Facility is Constructed with the Highest Level of Vapor Intrusion Protection Available



Site Details

Site Type

Commercial Storage

Contaminants of Concern

Chlorinated Solvents

Highlights



Future Tenants Protected
From Chlorinated Solvents



Land Science Offers Site-
Specific Design Support

38,000
Square Feet

38,000 Square Feet
Installed

Project Summary

The project site is a modern, climate-controlled self-storage facility that includes all-in-one moving, packing, and storage services for its customers. The building was developed on a former industrial brownfield at the site of a former factory. As part of Maryland's Voluntary Cleanup Program, the environmental consultant completed a Phase II investigation, finding elevated chlorinated solvent contaminants in the soil gas. The Maryland Department of Environment required the installation of a vapor mitigation system over a portion of the building. However, in working with the consultant, it was ultimately determined that a vapor barrier spanning the entire building footprint would be necessary to protect the future building tenants fully. Based on chlorinated solvent concentrations, TerraShield® was specified to provide the highest level of chemical resistance and long-term barrier performance available on the market. The project required active venting and a site-specific design, leveraging Land Science's vapor barrier design expertise. Additionally, the TerraShield vapor mitigation system included an extended material warranty to provide the project stakeholders added assurance that building occupants would be protected long into the future.

Results

The use of TerraShield ensures that chlorinated solvent vapors will be safely mitigated. Following the installation of the TerraShield vapor barrier system, the new modern storage and moving services facility meets safety and environmental regulatory requirements ensuring a safe environment for future building occupants.

New Jersey Warehouse Protected from Former Industrial Contaminants

Site-Specific Vapor Mitigation System Leads to Substantial Cost and Time Savings



Site Details

Site Type

Industrial

Contaminants of Concern

Petroleum Hydrocarbons
Chlorinated Solvents
Methane

Highlights



Former Industrial Property
Redeveloped in New Jersey



Substantial Cost and Time
Savings Realized

150,000
Square Feet

150,000 Square Feet
Installed

Project Summary

The building occupies a former industrial property in northern New Jersey, which has been developed into a large, nearly four-acre warehouse. Various contaminants, including chlorinated solvents and petroleum hydrocarbons, were historically used on-site, resulting in the presence of soil gas vapors and the potential for vapor intrusion. To mitigate this risk, the MonoShield[®] vapor barrier and a passive venting system were installed.

The original vapor mitigation design called for a traditional HDPE liner with a geotextile fabric to be installed below the liner. Land Science was able to save significant time and money by suggesting the use of the MonoShield vapor barrier. The MonoShield system uses a spray-applied nitrile-modified asphalt to seal the vapor barrier seams and penetrations, thus saving substantial time over traditional welding of HDPE liners. In addition, the MonoShield vapor barrier includes a geotextile fabric thermally bonded to the underside of the barrier, eliminating the need for the additional geotextile layer.

This site-specific design not only saved on the overall system cost, but it also sped up of the vapor barrier installation time which ensured the project was completed on time, meeting the growing demand for warehouse space in northern New Jersey.

Results

Land Science and a Land Science certified applicator developed a site-specific vapor mitigation system design that saved time and money while ensuring the solution was protective of future building occupants. The installation of the MonoShield vapor barrier system allows a safe environment for workers.

Nitra-Seal Applied at Major Office Complex in Midtown Atlanta

Future Office Workers of a Global Transportation Company will be Protected from Vapor Intrusion



Highlights



Land Science Provided Project Oversight to Ensure All Specifications Were Met

2,000,000
Square Foot Campus

2,000,000 Square Foot Campus

Site Details

Site Type

Commercial Office Campus

Contaminants of Concern

Chlorinated Solvents
Petroleum Hydrocarbons

Project Summary

The site is earmarked for approximately two million square feet of office space in Midtown Atlanta and consists of two office towers, twelve covered parking levels, and more than 250,000 square feet of multi-use space. The office campus is the future home of a global transportation company who chose this site for its prime location in an up-and-coming area of Atlanta. In considering long-term liability, the forward-thinking property developer and environmental consultant opted for the Nitra-Seal[®] vapor barrier system to provide reliable, lasting protection against the intrusion of soil gas vapors containing chlorinated solvent and petroleum hydrocarbons. Given the project's scope, the team requested Land Science's oversight to report to the general contractor and property owner on the vapor mitigation system's installation status while ensuring compliance with Land Science specifications. The installation was successful, meeting manufacturer specifications and on-time completion.

Results

Following the installation of the Nitra-Seal vapor barrier system, the new office campus satisfies the goal of providing lasting protection against vapor intrusion, and ensures a safe working environment for future office workers. The installation met the Land Science specifications and was completed on time, allowing the development to move forward.

Pre-emptive Vapor Mitigation Protects Students from Potential Exposure

Retro-Coat Vapor Barrier System Installed in a Southern California Public High School

Retro-Coat[®]

Vapor Intrusion Coating

Highlights



Due to onsite pesticide use, a vapor intrusion mitigation system was necessary to protect students and staff

14,000
Square Feet Installed

Retro-Coat was applied throughout the library building on campus

Site Details

Site Type

Institutional

Contaminants of Concern

Pesticides

Project Summary

Former operations at a public high school in Southern California noted the previous use of pesticides at the site. Due to prior pesticide use, contamination was monitored. In efforts to protect students and staff against potentially harmful vapor intrusion as a result of historic releases, a vapor intrusion barrier system was proposed as the most appropriate remedial approach. Retro-Coat[®], a vapor intrusion coating system offered by Land Science, was installed in the 14,000 square foot library located on the school campus.

Results

The Retro-Coat installation was successfully applied to mitigate any potential vapor intrusion. There are several buildings in the complex, this particular application happened in the library building. With the success of the application, the school district is now considering applying Retro-Coat at other properties in the district to mitigate any potential vapor intrusion caused by historic releases.

Land Science and REGENESIS Working Together for Your Success

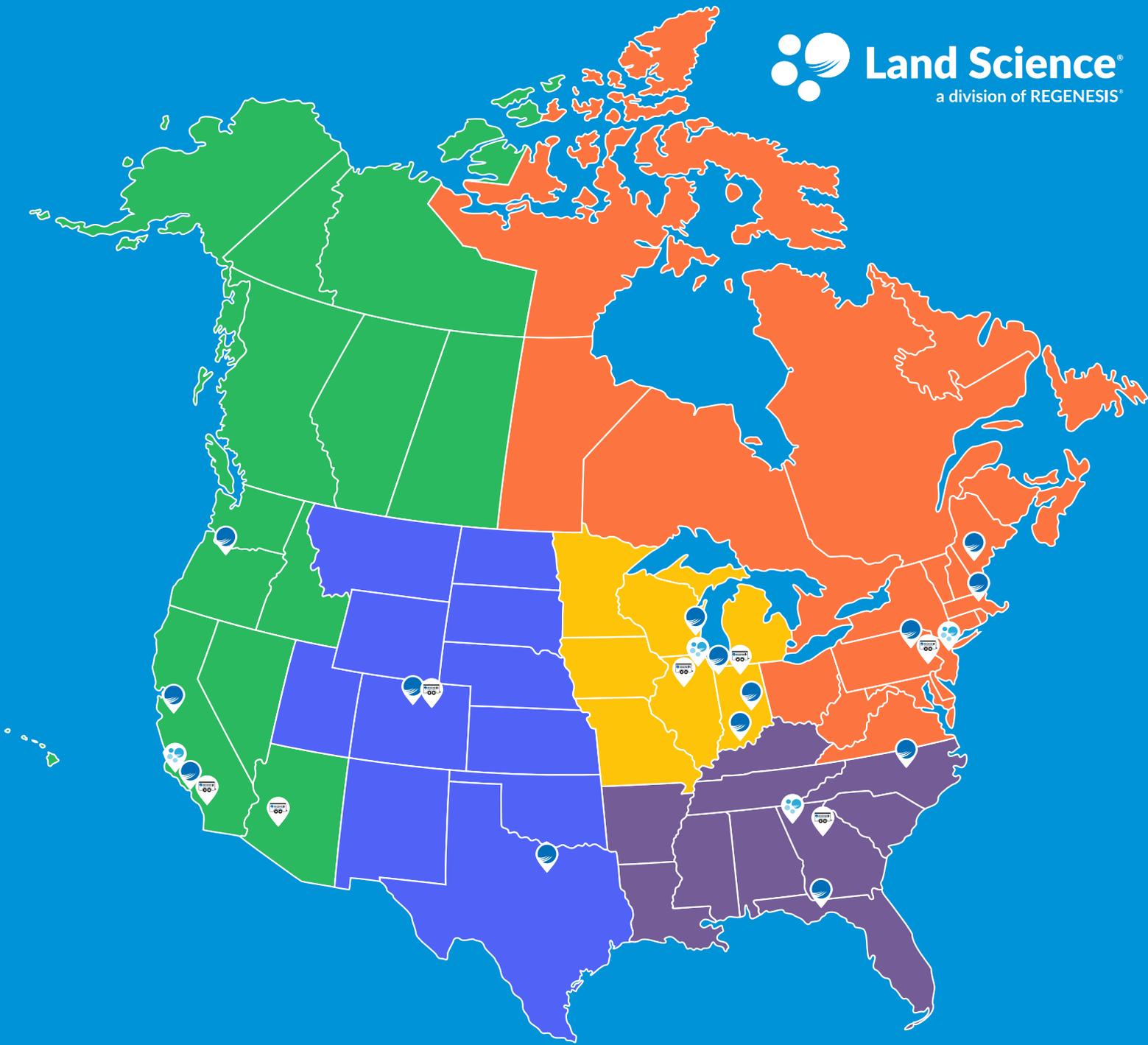
As a wholly-owned division of REGENESIS®, a recognized leader in the environmental industry, Land Science has been at the forefront of vapor intrusion mitigation. With combined experience in vapor intrusion mitigation and environmental remediation that encompasses more than 26,000 projects worldwide in over 27 countries, Land Science has a unique advantage over other vapor intrusion solution providers.

In addition to its own research and science-based product development, Land Science benefits from its close association with REGENESIS by aligning teams and managing a broad range of vapor intrusion mitigation issues. These products and solutions include patented vapor mitigation and environmental remediation technologies supported by the highest levels of scientific research.

World Class Clients

Environmental consultants, engineers, and real estate professionals trust Land Science to produce results knowing our expertise and industry knowledge has been proven time and again at the job site. Our world class clients include leaders in the food, banking, government, and housing industries.





We're Ready to Help You Find the Right Solution for Your Site

Global Headquarters

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Get Started Today

To receive a custom vapor intrusion solution, please call 949.481.8118 or e-mail info@landsciencetech.com. One of our Technical Solutions Managers will review your project details and provide you with a customized vapor intrusion solution designed to achieve your goals.



Are You Planning a Vapor Intrusion Mitigation Project? Contact us today for a free estimate.

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