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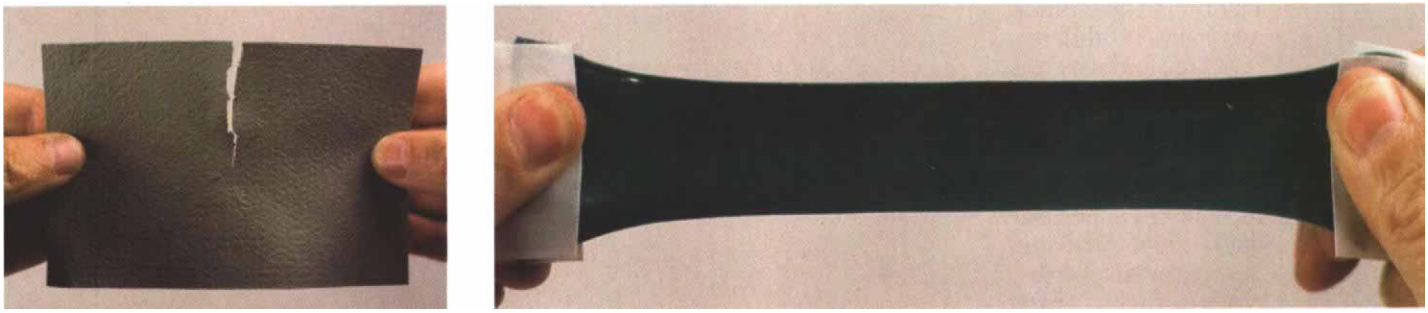
Selecting a Moisture-proofing System for New Basements

New products from the latest technologies offer more effective alternatives to slopping sticky tar onto new foundations



Flexibility means better protection. Flexible cementitious coatings (photo left) might be called waterproof, but their limited elasticity can cause them to crack where foundations do. Elastomeric membranes (photo right), such as RPC's Rub-R-Wall liquid-applied polymer, stretch to span cracks.

by Bruce Greenlaw

Basements rarely conjure up cheery thoughts. They usually remind me of something out of the horror film *A Nightmare on Elm Street*. And when it comes to moisture problems, the truth about basements is a real nightmare. Surveys indicate that between 33% and 60% of the 31,000,000 basements in single-family homes in the United States have moisture problems.

A wet basement is uninhabitable, and the mold or mildew that thrive in such a musty environment can ruin anything stored there. Worse, a wet basement can wick more than 10 lb. to 20 lb. of water vapor a day into a home's interior. In today's airtight homes, this moisture can condense in the building envelope, causing mold, mildew and eventually rot.

Basements don't need to be wet. There are scores of products that, when used appropriately and installed with care, help to keep basements dry. It's important to remember that these products are designed to function in *addition* to proper drainage. (For a detailed look at foundation drainage, see *FHB* #50, pp. 82-86.)

Waterproofing vs. damp-proofing—Some products are designed to waterproof foundations, while other products only damp-proof them. The American Society for Testing and Materials defines waterproofing as a treatment that *prevents* the passage of water under hydrostatic pressure. Damp-proofing, on the other hand, only *resists* the passage of water in the absence of hydrostatic pressure. Hydrostatic pressure is the force that is exerted on a foundation by the water that is in the ground that surrounds the foundation.

Determining the amount of hydrostatic pressure exerted on any given foundation is essential for choosing the appropriate foundation treatment. One way to predict the water-table fluctuations of a particular building site is to have a soils engineer perform an on-site soil test. A cheaper but probably less dependable way is to ask the neighbors.

Ultimately, the real question is whether it's generally better to damp-proof or to waterproof a basement. The Building Foundation Design Handbook, published by Oak Ridge National Laboratory (for more information on this booklet and other moisture-proofing publications, please see *Reviews,* p. 136), recommends waterproofing for all habitable basements because most basements are exposed to at least some hydrostatic pressure. But if you're not planning to use your basement as living space, or if the soil around your house is exceptionally well-drained, damp-proofing alone may be sufficient for the basement in your house.

Damp-proofing is less expensive but not as effective—Despite strong evidence that damp-proofing is insufficient in protecting basements from hydrostatic pressure, 95% of all builders damp-proof their basements, according to Micheal Sutton, a regional manager for Koch Materials Company, which makes the Tuff-N-Dri basement waterproofing system. The success rate is questionable: 85% of builders questioned in a National Association of Home Builders survey said that at least some of the basements they have built leak, costing an average of $1,000 to $2,000 per callback.

The standard practice for damp-proofing new basements is to apply one or two coats of unmodified asphalt (asphalt with no chemical additives) to the exterior side of the foundation walls from the footings to slightly above grade. These asphalts come in various grades suitable for brushing, rolling, squeegeeing, spraying or troweling. They cost roughly 40¢ to 60¢ installed per sq. ft. of basement-wall area.

Asphalt emulsions are easiest to work with—Water-based asphalt emulsions can be applied to damp substrates, including green concrete; they aren't flammable; they don't emit noxious fumes; and they clean up with water. They also can be used for gluing extruded polystyrene

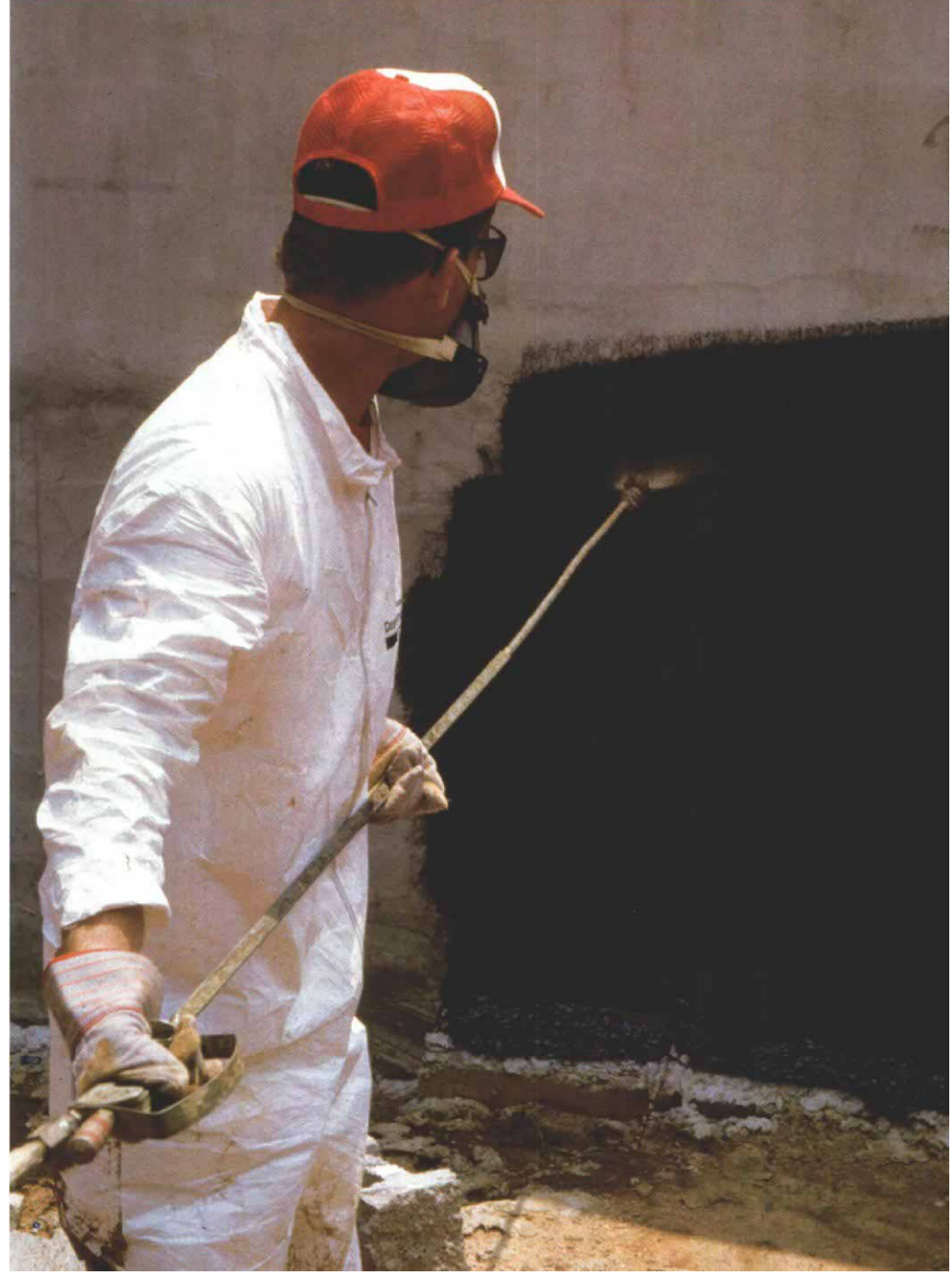
foam insulation (XEPS) to foundation walls. On the downside, emulsions must be protected from rain and freezing until they have dried, which can take several days in cool weather. Backfilling too soon can cause an uncured emulsified coating to deteriorate.

Cutback asphalts aren't bothered by weather—Cutback asphalts are solvent-based and normally aren't affected by rain or freezing. But most cannot be applied to green concrete or to wet substrates. Uncured, they're toxic and combustible, and they dissolve foam insulation.

The trouble with unmodified asphalt in general is that it is a byproduct of the oil-refining process, and incremental improvements in refining technology gradually have eliminated asphalt's elasticity. Today's asphalts won't span the cracks that invariably occur in basement walls as concrete shrinks and foundations settle or move in response to various other conditions. Asphalts also tend to embrittle or emulsify with age, exacerbating the problem.

According to Brent Anderson, a consulting engineer in Fridley, Minnesota, if you plan to damp-proof with asphalt emulsions or cutback asphalts, it is best to apply it 60 mil to 100 mil, or just more than 1/16 in. thick. Gauges for measuring coating thickness are available from Paul N. Gardner Company Inc. (P.O. Box 10688, Pompano Beach, Fla. 33061; 305-946-9454). Some builders improve the moisture protection of asphalt coatings by adding a layer of 6-mil polyethylene sheeting over the asphalt. Anderson says this treatment is an improvement but only if the top edges of the poly are carefully sealed to the foundation, and if the poly is protected from damage during construction.

Rubber damp-proofing is more elastic—Asphalt isn't the only material used for damp-proofing. One alternative is Rubber Polymer Corporation's new Rubber-Tite Damp Proofing Plus (for manufacturers' addresses, see sidebar p. 53), which is the only 100% rubber polymer damp-proofing I know of. This type of damp-proofing is much more flexible and better at spanning cracks than unmodified asphalt, but it degrades in sunlight and needs to be covered fast. It costs about 40¢ to 50¢ per sq. ft. installed, and it must be sprayed on by certified appliers.



Liquid-applied membranes are usually sprayed on. Liquid-applied polymer-modified asphalts such as Koch's Tuff-N-Dri emulsion cure to form seamless, self-flashing waterproof membranes over concrete or masonry. Photo courtesy Koch Materials Company.

Cementitious coatings are durable but don't stretch—Polymer-modified cementitious coatings such as Masterseal 550 (Master Builders Inc.) and Thoroseal Foundation Coating (Thoro System Products) also are used for damp-proofing. They cost about 20¢ to 65¢ per sq. ft. for materials, or about $1.25 to $2 per sq. ft. installed. These cementitious coatings occupy the gray area of moisture-proofing. Typically brushed or troweled on, they bond tenaciously to cured substrates and, in some cases, even stand up to hydrostatic pressure. They also breathe, which helps prevent basement condensation; they require no protection board; and they look good where they're exposed.

The trouble is, even the best polymer-modified cementitious coatings don't reliably bridge shrinkage and settling cracks (left photo, facing page). Instead, they tend to crack where foundations do, admitting water where protection is needed most.

When cementitious coatings are used as part of a built-up system that includes rigid-foam insulation, mesh reinforcement and synthetic stucco coatings, such as Sto's Below Grade System, they might truly waterproof foundations. But regardless of what manufacturers claim, cementitious coatings generally are considered by building codes as damp-proofing, not waterproofing.

Waterproofing keeps all moisture out—If you elect to waterproof instead of damp-proof, there are several factors to consider when choosing an appropriate material. Products can differ in everything from shelf life and compatibility with form-release agents to ease of application and cost. Some membranes require protection against backfill; others don't. Also, some membranes can be installed by the average contractor, while others have to be installed by factory-certified technicians.

Laminated-asphalt basement waterproofing is similar to built-up roofing—Laminated-asphalt waterproofing consists of two or more layers of a hot-applied or cold-applied unmodified asphalt, reinforced with alternating layers of a fiberglass or asphalt-saturated cotton fabric. Hot-applied laminated asphalts are seldom used to-

Peel-and-stick membranes stretch to bridge cracks. Self-adhering rubberized asphalt membranes such as W. R. Grace's Bituthene withstand tremendous hydrostatic pressure and can be backfilled immediately. Joints between footings and walls are covered with mastic or mortar for durability. Photo courtesy W. R. Grace & Company.

Thwarting condensation. An insulating board provides protection from backfill and helps eliminate interior condensation. Photo courtesy Dow Chemical Company.

day because they generate nasty fumes and pose a fire hazard during installation. Some companies, however, still promote cold-laminated asphalts as basement waterproofing. These asphalts are essentially the same ones used in damp-proofing, only they are installed in conjunction with fabrics designed to reinforce and augment moisture-proofing. Henry, for example, sells a fiberglass fabric for laminating its #107 asphalt emulsion.

The system has been approved by the city of Los Angeles for use as below-grade waterproofing, with the number of laminations used based on the amount of hydrostatic pressure.

Laminated asphalts cost less than $1 per sq. ft. for materials for a two-ply membrane. They span cracks better and are more durable than unlaminated asphalts, but they're inferior to many other waterproofing systems on both counts. Hot or cold, installation can be awkward, messy and time-consuming. Given the questionable long-term performance of unmodified asphalts, it might pay to take a hard look at the alternatives.

Liquid-applied elastomeric membranes are the most widely used waterproofing systems—Sprayed-on liquids that cure to form elastic membranes are probably the most popular basement-waterproofing products on the market, and for good reason. Not only can they be applied quickly to concrete or masonry (an experienced person can apply about 1,000 sq. ft. per hour), but they cure to form seamless, self-flashing membranes. These membranes conform to complex surfaces, such as curved walls or walls that have a lot of lines or pipes passing through, and they span cracks up to 1/16 in. wide. Also, because the entire membrane bonds to substrates, leaks are confined to small areas that can be detected and repaired easily.

Liquid-applied elastomers aren't perfect, though. Successful application requires painstaking preparation of substrates, meaning that voids must be filled with a nonshrinking grout or mastic; fins and lumps in the concrete must be removed; and surfaces must be clean and dry, or the membrane can blister or pinhole. For optimal performance, the thickness of the membrane must be monitored very carefully during application to ensure compliance with manufacturer's specifications (35 mil to 60 mil is typical). Also, some products must be heated and then sprayed on using expensive gear, which is bad news for do-it-yourselfers. In fact, many of these products require factory-certified application, although the products usually are backed by good warranties.

Polymer-modified asphalts span cracks better and last longer—It's amazing what a little rubber can do for asphalt. The addition of rubber polymers dramatically increases asphalt's elasticity and longevity. At the same time, these sprayed-on modified asphalts are less expensive than many industrial-strength alternatives.

The two-part Tuff-N-Dri waterproofing system sold by Koch Materials consists of a polymer-modified asphalt emulsion, plus Warm-N-Dri semirigid fiberglass panels. Installed by certified appliers only, the Tuff-N-Dri membrane is applied with an airless sprayer (photo p. 49) at ambient temperatures down to 20 °F. It adheres to green concrete and heals itself if punctured. The Warm-N-Dri panel protects the membrane from backfill, conveys groundwater to perimeter drains to prevent the buildup of hydrostatic pressure and insulates, which on the exterior side of basement walls helps eliminate interior condensation. This system is ideal if you live in a cooler climate and plan to use your basement for living space. The system costs about 90¢ to $1.90 per sq. ft. (including labor), depending on your location and the system's R-value, and it carries a 10-year limited warranty.

Mar-Flex's Mar-Kote Drain & Dry Waterproofing System is similar to Tuff-N-Dri, except that its modified asphalt contains aromatic solvents that evaporate completely and won't leach into the soil after backfilling. It can be applied at temperatures down to 0°F. This system costs about 90¢ to $1.20 per sq. ft., installation by certified contractors included. For the past seven years, Terra-Dome Corporation in Grain Valley, Missouri, has had excellent results using a hybrid system in the poured-concrete underground homes it builds. The heart of its system is a neoprene-modified asphalt emulsion made by Technical Coatings, called ADF-100. ADF-100 can be brushed, rolled, squeegeed or sprayed. Once cured, it stretches up to 2,000% to bridge cracks. For extra moisture protection, Terra-Dome trowels ADF-500 mastic over cold joints before ADF-100 is applied, then lays strips of a bentonite sheeting called Paraseal over the joint locations (more on bentonite later). The whole thing is covered with an insulating shell of XEPS foam before backfilling.

Paul Bierman-Lytle, a New Canaan, Connecticut, architect and builder whose specialty is nontoxic houses, swears by yet another modified asphalt called Safecoat DynoSeal. Made by American Formulating and Manufacturing, it's a neoprene-modified asphalt emulsion that's designed for use by and for chemically sensitive people and for anyone else concerned with using nontoxic products. It can be applied only at ambient temperatures ranging from 45°F to 90°F, though, and costs more than the other modified asphalts: $1.12 to $1.20 per sq. ft., plus application. Bierman-Lytle has used DynoSeal in conjunction with a top-notch subsurface drainage system for the past six years and said he has had great results.

Liquid-applied polymers have the best stretch—Rubber Polymer Corporation's literature shows a guy trying to punch through a cured sample of the company's Rub-R-Wall waterproofing membrane. Instead of breaking, the green membrane stretches the length of his arm.

Although the dynamics of a right jab and a cracking foundation are dramatically different, it is the stretchability of rubber polymers that is their greatest attribute.

Rub-R-Wall is heated and then sprayed by certified contractors over concrete, masonry or rigid-foam foundation forms to a cured thickness of 40 mil. The membrane can be applied to frozen (but not icy) substrates at ambient temperatures down to 15 °F. Drainage board or rigid-foam insulation can be attached to its sticky surface 15 minutes after application, and the surface stays tacky for several days. The bond is tenacious, though, *so* boards and panels must be positioned right the first time. (I know of one guy who used Rub-R-Wall to glue a detached heel back onto his boot.) Rub-R-Wall isn't UV-stabilized, so it needs to be covered promptly. Backfilling can proceed as quickly as 24 hours after application.

In its liquid state, Rub-R-Wall is flammable and toxic, but it's nontoxic when cured. Once cured, it stretches up to 1,800% to span foundation cracks (right photo, p. 48). Independent tests project a 100-year, below-grade life span for Rub-R-Wall, and RPC backs this up with a lifetime limited warrantee. Installed price ranges from about 90¢ to $1.50 per sq. ft. RPC also makes a low-cost alternative to Rub-R-Wall called Graywall. It stretches as much as 1,400% instead of 1,800% and is half the price of Rub-R-Wall.

For builders who can't backfill right away and where UV deterioration is a concern, Mar-Flex recently introduced a 100% polymer product, similar to Rub-R-Wall but with UV stabilizers, called Sunflex. This product's bright-yellow membrane allows limited exposure to sunlight before backfilling. According to Mar-Flex, the installed cost of this membrane ranges from 70¢ to $1.15 per sq. ft.

If you're unlucky enough to get stuck with waterproofing a basement at -10°F, Poly-Wall might save the day. Made by Poly-Wall International, it's a mineral-fortified thermoplastic polymer that can be sprayed, brushed or rolled over cured or uncured concrete or unparged masonry at temperatures down to -10°F. Poly-Wall cures to a glossy gray color (or it can be painted) so it looks good above grade. It requires no protection board and can be backfilled within four hours during summer or the next day during winter. Applied by certified contractors only, it costs just 45¢ to 60¢ per sq. ft., including labor, and has a life expectancy of more than 50 years. What's the catch? Poly-Wall is only slightly elastic, so it doesn't span cracks as well as most other liquid-applied membranes do.

Sheet-applied elastic membranes withstand tremendous hydrostatic pressure—Sheet-applied elastomers are best sellers on the commercial market. Home builders, however, generally use them for high-end work only. This usage is because these membranes withstand enormous hydrostatic pressure, which is typically not encountered in residential work, and consequently cost more than most of the other products I've mentioned. Prices can range from $1.50 to $2 per sq. ft. installed.

Dimple sheeting provides drainage. This polyethylene sheeting resists moisture while the dimples provide air gaps that channel away any groundwater that might get through. Photo by Brent Anderson.

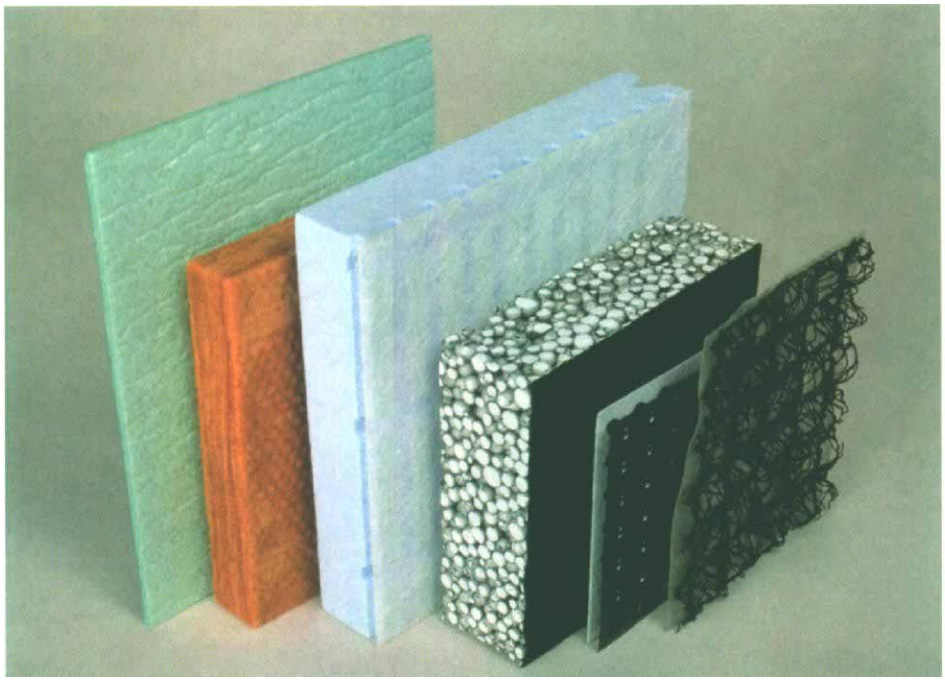
The most common sheet-applied elastomers are 60 mil thick and consist of a layer of self-adhering rubberized asphalt that's laminated to a waterproof polyethylene film on one side and covered by a protective release sheet on the other. Available in 3-ft. to 4-ft. wide rolls, the peel-and-stick membranes install vertically over primed substrates, adhering fully to localize leaks. Edges are sealed by special mastics.

Peel-and-stick membranes offer two layers of waterproofing to bridge cracks. The factory-controlled thickness helps eliminate the thin spots and holidays (skips) that result from spraying. Membranes don't pinhole, can be applied at temperatures as low as 25°F depending on the formula and can be backfilled immediately to eliminate job-site delays.

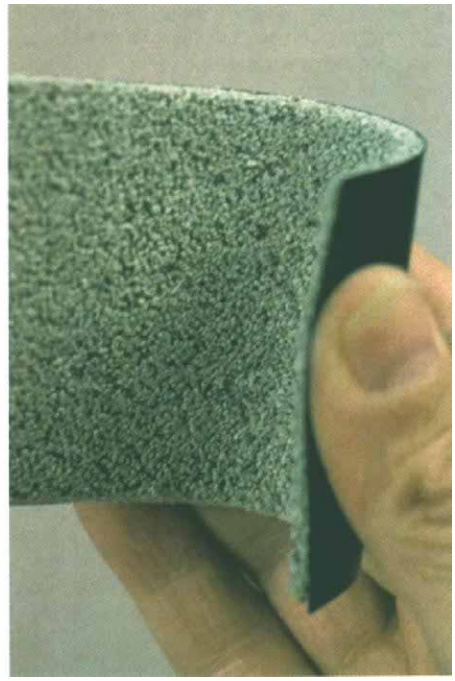
On the flipside, peel-and-stick membranes don't conform well to complex surfaces, and they're difficult to flash. In addition, concrete substrates must cure for at least seven days before application and must be dry, thawed and free of voids, fins and other defects that could puncture the membrane. Also, time-consuming detailing is required at the inside corners and at the outside corners.

Once the sheets are applied, they can be difficult to reposition. They must be put on perfectly to avoid wrinkles, which need to be cut and repaired before backfilling. Protection board or matting also is required.

W. R. Grace's Bituthene (left photo, facing page) has been on the market for about 25 years, so it's generally considered to be the standard



Protection, insulation and drainage material work alongside waterproofing membranes. These boards and mats protect basement moisture-proofing from potentially damaging backfill. The two mats on the right also direct groundwater to perimeter drains, while the middle three boards do that plus provide insulation. Left to right: Amoco Amocor-PB4 fanfolded, extruded polystyrene protection board; Koch Warm-N-Dri semirigid fiberglass insulating drainage panel (sold as a part of the Tuff-N-Dri system only); Dow Thermadry extruded polystyrene insulating drainage panel; GeoTech expanded polystyrene insulating drainage panel; Miradrain 2000R prefabricated drainage composite; and Akzo Enkadrain B drainage mat.



Bentonite clay is mined from the Black Hills. Mameco's Paraseal is made up of granular bentonite clay, laminated to a tough, impermeable high-density polyethylene sheeting. Groundwater causes the bentonite to swell to six times its dry volume, which then forms a waterproof gel.

peel-and-stick waterproofing membrane in the industry. But similar products are made by Karnak, W. R. Meadows, Mirafi, Pecora, Polyguard and Polyken.

The Noble Company sells a different brand of elastic waterproof sheeting. Called NobleSeal, it's a chlorinated polyethylene (CPE) material that comes in 5-ft. wide by 100-ft, long rolls in thicknesses ranging from 20 mil to 40 mil. NobleSeal can be spot-bonded, applied to a grid of adhesive, fully adhered, mechanically fastened or even loosely draped over foundation walls, spanning cracks up to ¼ in. wide (except when it's fully adhered). Seams are chemically welded. One distributor quotes the uninstalled price of NobleSeal at 60¢ to $1.20 per sq. ft., depending on thickness. Installation, however, can double that price.

Bentonite clay is nontoxic and is touted to last forever—Bentonite clay is another relatively expensive waterproofing material that handles great hydrostatic pressure and is used mostly for commercial or specialized residential work. The clay has been used in civil-engineering products since the 1920's and by builders since 1964. It's also used in toothpaste.

The key to bentonite's effectiveness is that it swells up to 15 times its dry volume when wet to form a sticky, impermeable gel in confined spaces. Not only is bentonite supposed to last forever, but it's also seamless, self-healing and nontoxic. It also can be applied in cold weather. Most bentonite products can be installed with ordinary tools over masonry or green concrete with minimal surface preparation. Foundations can be backfilled immediately, in most cases without protection board, although a drainage layer might be required in some soils. Bentonite also can be an excellent choice for waterproofing slabs in extreme conditions.

On the downside, bentonite must be shielded from rain until backfilling, or it can wash away. Free-flowing groundwater can erode it even after backfilling. Also, some products have limited tolerance to soil salts, alkalis and acids, though salt-resistant bentonite is available.

Bentonite comes in bulk for spray-on application or packed into 4-ft. by 4-ft. cardboard panels that dissolve after backfilling to leave a continuous bentonite membrane. Spray-on bentonite needs special equipment and skill to apply, and I've heard that the cardboard panels can leak at the seams before the cardboard disintegrates. I'd use bentonite sheets or mats instead (photo above right), such as the Mameco Paraseal that Terra-Dome uses. It comes in 4-ft. wide rolls and features granular bentonite laminated to a tough waterproof high-density polyethylene (HDPE) film. Another alternative to Paraseal is Mirafi's Miraclay matting, which costs about 60¢ to 80¢ per sq. ft. for the material or up to about $2 per sq. ft. installed.

San Francisco Bay-area builder Richard Kjelland, who has moisture-proofed foundations with everything from unmodified asphalt to Bituthene, tells me that bentonite sheets come in handy in tight spaces because they can simply be draped down foundation walls. This flexibility makes them a viable alternative where roomy foundation trenches are impractical. Paraseal can also be used extensively for waterproofing the outside of old rubble foundations, which are too rough and dirty to accept most other types of waterproofing membranes.

Dimple sheeting diverts water while moisture-proofing—Relatively new to the United States but big in Europe, dimple sheeting is a low-cost waterproof membrane that doubles as a drainage mat. Delta-MS sheeting, which is made in Germany and is sold by Intercontinental Construction & Equipment, is a 24-mil, dimpled HDPE sheeting that looks like an egg carton in profile. Available in rolls up to 8 ft. wide, it's simply rolled over concrete, masonry or wood foundations and tacked up with special washered nails (photo p. 51). It can be installed over substrates in any condition and backfilled whenever you're ready. The membrane not only repels water but also forms air gaps against the basement wall that will channel to footing drains any groundwater that might get through the membrane. These air spaces also allow the escape of indoor water vapor that condenses on the outside of the foundation. Depending on the quantity you order, Delta-MS costs 25¢ to 40¢ per sq. ft., and installation is supposed to take about one man-hour per 500 sq. ft. The Norwegian-made System Platon, sold by Big "O" Inc. in Canada, is almost identical to Delta-MS.

Additional products augment moisture-proofing—As I've said, some moisture-proofing membranes need to be protected from backfill.

Moisture-proofing manufacturers

Here's a list of the manufacturers mentioned in this article. For a more comprehensive list, see Aberdeen's annual Concrete SourceBook (available for $30 plus shipping from The Aberdeen Group, 426 S. Westgate, Addison, Ill. 60101; 800-323-3550). It's a 688-page directory that not only covers moisture-proofing, but also just about everything else concerning concrete.

For names of local waterproofers, check the Yellow Pages, ask manufacturers or call the Sealant, Waterproofing & Restoration Institute (3101 Broadway, Suite 585, Kansas City, Mo. 64111; 816-561-8230). The SWRI will also field waterproofing questions. If it can't answer a question, it will try to locate someone who can.

-B. G.

***AKZO Nobel Geosynthetics Co.,* P. O. Box 7249, Asheville, N. C. 28802; (704) 665-5050.**

***American* Formulating *and Manufacturing,* 350 W. Ash St., Suite 700, San Diego, Calif. 92101; (619) 239-0321.**

***American Wick Drain Co.,* 301 Warehouse Drive, Matthews, N. C. 28105; (800) 242-9425.**

***Amoco Foam Products Co.,* 375 Northridge Road, Suite 600, Atlanta, Ga. 30350; (800) 241-4402.**

***Big "O" Inc.,* 254 Thames Road East, Exeter, Ontario, Canada NOM 1S3; (519) 235-0870.**

***The Dow Chemical Co.,* Customer Information Center, 690 Building, Door 1. Midland, Mich. 48640; (800) 232-2436.**

***GeoTech Systems Corp.,* 22377 Cedar Green Road, Sterling, Va. 20166; (703) 450-2366.**

***W. R. Grace & Co.,* 62 Whittemore Ave., Cambridge, Mass. 02140; (617) 876-1400.**

***Henry Co.,* 2911 Slauson Ave., Huntington Park, Calif. 90255; (213) 583-5000.**

***Intercontinental Construction & Equipment Inc. (ICE),* 7666 Highway 65 N. E., Fridley, Minn. 55432; (612) 784-8406.**

***Karnak Corp.,* 330 Central Ave., Clark, N. J. 07066; (800) 526-4236.**

***Koch Materials Co.,* 800 Irving Wick Drive, P. O. Box 2155, Heath, Ohio 43056; (800) 379-2768.**

***Linq Industrial Fabrics Inc.,* 2550 W. Fifth North St., Summerville, S. C. 29483; (800) 543-9966.**

***Mameco International Inc.,* 4475 E. 175th St., Cleveland, Ohio 44128; (800) 321-6412.**

***Mar-Flex Systems Inc.,* 6866 Chrisman Lane, Middletown, Ohio 45042; (800) 498-1411.**

***Master Builders Inc.,* 23700 Chagrin Blvd., Beachwood, Ohio 44122; (800) 227-3350.**

***W. R. Meadows Inc.,* P. O. Box 2284, York, Pa. 17405; (800) 342-5976.**

***Mirafi,* Division of Nicolon Corp., 3500 Parkway Lane, Suite 500, Norcross, Ga. 30092; (800) 234-0484.**

***The Noble Co.,* 614 Monroe St., Grand Haven, Mich. 49417; (800) 878-5788.**

***Pecora Corp.,* 165 Wambold Road, Harleysville, Pa. 19438; (800) 523-6688.**

***Polyguard Products Inc.,* P. O. Box 755, Ennis, Texas 75120-0755; (800) 541-4994.**

***Polyken Technologies,* 15 Hampshire St., Building 2, Mansfield, Mass. 02048; (800) 248-7659.**

***Poly-Wall International Inc.,* 1879 Buerkle Road, White Bear Lake, Minn. 55110; (800) 846-3020.**

***Retro Technologies Inc.,* 3865 Hoepker Road, Madison, Wis. 53704; (608) 849-9000.**

***Rubber Polymer Corp. (RFC),* 1135 West Portage Trail Extension, Akron, Ohio 44333; (800) 860-772L**

***Sto Industries,* P. O. Box 44609, Atlanta, Ga. 30336-5609; (800) 221-2397.**

***Technical Coatings Division,* S. A. D. I., 5536 Business Park, San Antonio, Texas 78218; (210) 666-2777.**

***Thoro System Products,* 8570 Phillips Highway, Suite 100, Jacksonville, Fla. 32257; (800) 327-1570.**

***V. C. Industries Inc.,* 3 Century Drive, Parsippany, N. J. 07054; (201) 267-1605.**

Fiberboard and even roofing felt are traditional choices, but a wealth of innovative substitutes now gives membranes more than just protection (left photo, facing page), offering insulation and providing drainage.

For backfill protection only, Amoco, Dow Chemical and U. C. Industries sell fanfolded XEPS panels that open into convenient, 4-ft. wide by 50-ft. long blankets. This foam blanket sticks beautifully to tacky, liquid-applied waterproof membranes such as Rub-R-Wall, or it can be glued with compatible adhesives to other properly cured membranes. Fanfolded protection boards are a measly ¼ in. or ⅜ in. thick, however, and therefore they can offer only a limited amount of insulation.

If it's an insulating-protection board you're after, all three companies also sell XEPS below-grade insulation panels. Amoco's panels are available as much as 3 in. thick, while Dow's (right photo, p. 50) and U. C. Industries' come as much as 4 in. thick. These panels need their own protection where they extend above grade to prevent UV and baseball degradation. Retro Technologies makes a protective, stuccolike coating that can be brushed, rolled or sprayed over the exposed foam.

Besides Koch's Warm-N-Dri and Mar-Flex's Drain & Dry, other products are available that protect, insulate and provide drainage. Dow Chemical's Thermadry is a 2-ft. by 8-ft. tongue-and-groove XEPS panel with a grid of channels on one side that direct groundwater to perimeter drains without affecting the panel's R-value. The channels are covered by a spin-bonded filter fabric that admits water but keeps soil out. Panel thickness ranges from 1 in. to 2¼ in., with R-values ranging from R-4.4 to R-10.6. U. C. Industries' similar Foamular Insul-Drain board comes in 4-ft. wide panels.

GeoTech's Insulated Drainage Board/Panel, on the other hand, consists of expanded polystyrene beads bonded into a 4-ft. by 4-ft. panel that is available in thicknesses up to 2 ft. thick, although 2 in. is usually adequate for most residential applications. Groundwater drains between the beads. The panels are available with or without a filter-fabric skin.

Geocomposites are other products that protect foundations from backfill and hydrostatic pressure, but they don't insulate them. Most geocomposites don't look very sophisticated, but they've earned their stripes in tough commercial applications. The most common geocomposites consist of an impermeable dimpled plastic sheet with a filter fabric glued onto the dimples. The sheets measure ¼ in. to ¾ in. thick, come in 2-ft. to 4-ft. wide rolls and are either nailed, glued or taped up with the dimples and filter fabric facing away from the substrate. After backfilling, the dimples and fabric team up to form silt-free subsurface waterways. Compressive strengths range from 10,000 lb. to 15,000 lb. per sq. ft., strong enough to restrain backfill without collapsing. Manufacturers I'm familiar with include American Wick Drain, Linq Industrial Fabrics, W. R. Grace and Mirafi. Price varies, but Mirafi's residential Miradrain 2000R geocomposite costs about 35¢ to 45¢ persq. ft.

Akzo's Enkadrain is a different type of geocomposite that's quickly gaining ground in the residential market. The residential version, called Enkadrain B, is a 0.4-in. thick mat composed of a systematic tangle of HDPE filaments bonded on one side to a filter fabric. It comes in 39-in. wide by 100-ft. long rolls and, where I live, costs about 30¢ to 35¢ persq.ft. □

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