



# **Debra's Guide to Creating a Green Bathroom**

a case study  
of her own remodel

*Debra Lynn Dadd  
Larry Redalia*

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Debra's Guide to

**Creating a  
GREEN  
BATHROOM**

**Debra Lynn Dadd  
Larry Redalia**



**OAK GROVE OMNIMEDIA**  
Clearwater, Florida

## ***Creating a Green Bathroom***

First Edition

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OAK GROVE OMNIMEDIA

Oak Grove Omnimedia, 411 Cleveland Street #263, Clearwater,  
Florida 33755

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*Conduct yourself in all matters,  
grand and public or small and domestic,  
in accordance with the laws of nature.  
Harmonizing your will with nature  
should be your utmost ideal.*

*Where do you practice this ideal?  
In the particulars of your own daily life  
with its uniquely personal tasks and duties.*

*When you carry out your tasks,  
such as taking a bath,  
do so, to the best of your ability,  
in harmony with nature...  
and so on.*

Epictetus





## ABOUT THE AUTHORS



Hailed as “The Queen of Green” by the New York Times, **Debra Lynn Dadd** has been a leading consumer advocate for products and lifestyle choices that are better for health and the environment since 1982. She is the author of *Home Safe Home: Creating a Healthy Home Environment by Reducing Exposure to Toxic Household Products*, and publisher of Debra's List, an online directory with 100s of links to 1000s of green products. She also facilitates a Green Living Q&A blog and is available for personal consultations.

Debra was one of the first to remodel with health and the environment in mind and one of the first to write about green building in 1986. She has more than twenty years of experience working with homeowners, architects, contractors, and builders on choosing green building and finishing materials for residential construction, as well as hands-on experience with continuous green remodeling projects on her own homes.

**Larry Redalia** is the happy husband of Debra Lynn Dadd. They have been together for twenty years. During this time they have collaborated on many green remodeling projects on their homes. Larry has been a do-it-yourself handyman owner/builder for more than thirty years and has worked on many construction sites.



Currently Larry is remodeling an investment house as well as the couple's private residence.

Remodeling is an exciting co-creative activity the couple loves to do together, each contributing their complementary skills in a synergistic relationship.



# CONTENTS

INTRODUCTION .....	13
THE SHOWER.....	21
TILE & MARBLE .....	25
PLUMBING & FIXTURES.....	33
VANITY & MEDICINE CABINET.....	37
PLASTER & PAINT.....	38
LIGHT & VENTILATION.....	40
TOWELS .....	43
STORAGE .....	44
BODY CARE PRODUCTS.....	45
CLEANING .....	46
NATURE .....	47
DIRECTORY OF PRODUCTS USED .....	49



# INTRODUCTION

*This is a case study of how we applied green principles to a remodel of the bathroom in our own home. It is not intended to be an overview of all possible options for green bathroom construction and design.*

**O**ur green bathroom remodel began in December 2005 and was completed in December 2006. It took this long because we did all the construction work ourselves, working on it only part-time.

We live in a single family home built in 1940 in Clearwater, Florida. We had both developed some sleep problems in the previous six months and some minor respiratory problems as well. Debra knew it wasn't chemical exposure, because we had already eliminated all possible toxic chemical exposures, so what was it?

Serendipitously, just as the problem was getting to the point where we needed to find a solution, we were asked if we were willing to have our house be inspected by a group of Bau-Biologie students. They had completed their training with the International Institute for Bau-Biologie and Ecology to be Bau-

## Bau-Biologie

Bau-Biologie is literally translated from the German as "building biology." These terms are used interchangeably.

A Bau-Biologist is a professional who has completed a specific training course in Bau-Biologie and has received a certification to practice as a Bau-Biologist. If one has not been trained and is not certified, it would be correct to say, "I apply Bau-Biologie principles..."

Bau-Biologie advocates buildings that contribute positively to the occupant's health of spirit, mind and body and have a low impact on the environment. It is the practice of bringing the home environment in line with the conditions found in natural environments as closely as possible.

The Bau-biologie home inspection includes evaluating exposures to toxic chemicals, microorganisms (mold and bacteria, and other micro air pollutants such as dust, dander, and other particles), electromagnetic fields (both manmade and natural), radiation from various sources natural and manmade, and thermal and moisture conditions.

A certified Bau-Biologie inspector will look at all of these concerns and make recommendations on how to change conditions in a home to optimize all these factors for good health.

For more information on Bau-Biologie, contact the **International Institute for Bau-biologie and Ecology** at <http://www.buildingbiology.net/>.

Biologie home inspectors, and needed to do an actual home inspection under the supervision of the instructor before receiving their certifications.

This was a great opportunity for us to have our home inspected from a Bau-biologie perspective! And not just by one inspector, but by a dozen!

## **HUMIDITY, MOISTURE AND MOLD**

Humidity is an important factor for indoor air quality that most people don't pay much attention to. In Debra's book *Home Safe Home: Creating a Healthy Home Environment by Reducing Exposure to Toxic Household Products*, she included a short section on Humidity and mentioned "High relative humidity, over 50 percent, encourages biological agents--such as bacteria and viruses, house-dust mites, and molds--to grow and be released into the air." Then she went on to discuss how humidifiers and de-humidifiers could be used to control humidity both for comfort and to reduce biological agents.

But during the inspection we learned that, as with toxic chemicals, it's better to reduce humidity at it's source rather than use a machine to try to correct an unbalanced environment.

The Bau-biologie students found we had conditions at our house both outside and inside that were affecting the humidity in our home. This humidity problem was the causing a major mold problem that was affecting our health and needed fixing right away.

The inspectors tested for humidity outdoors, and in our kitchen, living room, bedroom, and bathroom.

Outdoors, that day, the humidity was 67%. Outdoors, it is not an issue because we can't control outdoor humidity. If it were indoors, however, 67% would be considered "strong--unacceptable biological risk, remediation should be done as soon as possible". And this was on a clear winter day when we Floridians are rejoicing that it is "not humid"! In the summer, the humidity is much worse! But during the summer months, the humidity indoors is lowered by the air conditioner. Because it doesn't feel humid to us in the winter, it never occurred to us that the humidity could still be too high.

Both the kitchen and bathroom had even higher relative humidity levels, though still in the strong zone. This could be expected since those are the two rooms where water is used, but further inspection revealed problem areas that could be fixed to reduce the humidity in those rooms.

They also tested various materials for "relative wetness". Excessive levels of moisture were found in two locations in the bathroom. A problem was beginning to reveal itself...



In a visual inspection of the crawlspace under the bathroom, the inspectors found visible mold, so a sample was taken for laboratory analysis. The test results showed the presence of *Aspergillus/Penicillium*, *Curvularia* and *Scopulariopsis*. The report stated, the presence of these molds "is really troubling as these have been known to trigger respiratory problems and other,

sometimes severe, health symptoms". These molds require high moisture requirements for growth.

Because of the high moisture content, there was some concern—before the lab results came back—that there might be *Stachybotrys* mold present. I knew about *Stachybotrys* because it made the news in 1994 when it was associated with acute bleeding of the lungs in a cluster of infants in Cleveland, Ohio. One infant died. Though Debra wrote in *Home Safe Home*, "Constant moisture is required for it to grow, so don't be concerned about it unless you have water damage, water leaks, condensation, water infiltration, or flooding," to us this meant if your house was flooded, not that you have a leak in the bathroom.

Though we were fortunate to not have *Stachybotrys* in our house, our house apparently did have the conditions in which it can grow. *In both this house and in our previous house in California, the bathrooms were not installed correctly and there were moisture leaks sufficient to saturate the flooring under the tub. Because these leaks were hidden, we could not see the damage that was occurring.* In California, we finally addressed the problem when the tiles started falling off the wall

and we found the greenboard behind them to be saturated with water and falling apart and the wood behind that full of dry rot. Here, in Florida, the paint was peeling off the wall near the leak. So this is something to watch out for in any home.

For us, this discovery of mold was a major finding. Apparently there was enough mold to contribute to health problems. Because the mold wasn't visible from inside the house, we probably would not have found it on our own.

The Bau-biologie Home Inspection report recommended that we have an inspection by a certified mold remediation contractor to determine the extent of the mold problem and properly remove it. "Properly remove it" in our case meant having our entire bathroom ripped out down to the studs by a professional mold remediation contractor because the mold was in the floor. And then we would need to entirely replace the bathroom with a new one. This was a bit of a shock so it took us about a month before we made that call. Meanwhile, the smell of mold was getting stronger and stronger.

## **THE MOLD INSPECTION AND REMEDIATION**

After our Bau-Biologie Home Inspection found evidence of mold and inspection and removal of the mold by a certified mold remediation contractor was recommended, we considered the options. Clearly, we needed to do *something* about the mold.

First, Larry went down under the bathroom and sprayed the visible mold with straight 35% hydrogen peroxide (this is very caustic and should only be used with proper protective gear). That killed the visible mold, but it didn't handle the mold problem. We could still smell the mold and still had sinus irritations. We knew that if we didn't take care of the mold NOW, that it would get worse and eventually contaminate the whole house. That would be even more expensive to clean up.

But we were faced with having to rip out and rebuild our entire bathroom. Pipes had been leaking in the walls, and the floor was saturated to the point where visible mold was growing underneath the floor. While we knew we would need to remodel the bathroom eventually—as half of it was original from 1940 and the other half a



bad 1960's remodel—the funds to do so were not in our immediate budget.

The first thing we had to take care of was having access to bathroom facilities while this bathroom was being demolished for mold remediation and then rebuilt. Our house has one-and-a-half baths, so we had another toilet, but not another shower. Fortunately, we had another house we were remodeling for a rental a few miles away, but that shower was also unusable because it's tiles were falling off the wall (same problem!). So it seemed the first step to remodeling this bathroom was to do a new tile installation on that shower so we could have a shower. While we were grateful to have this shower available, it wasn't easy to have to make that drive every day just to take a shower. On the plus side, it did give Larry some practice installing the shower tiles and we used some beautiful glass tiles with recycled content for the accent tiles. We liked how it looked so much that we ended up using the same field tiles in our bathroom.

We considered whether or not we could do the mold clean-up ourselves. But then we found out that proper mold removal required containing the space so that the mold spores wouldn't infiltrate the rest of the house when they were moved, and that all the mold-contaminated material needed to be taken away in plastic bags. We really wanted to make sure that this was done right, so we finally called two certified mold remediation contractors.

The first contractor was very helpful and friendly. He gave us an estimate of \$1500. He also suggested we call our homeowner's insurance and see if they would cover it. He only did the mold removal, but referred us to several contractors who could rebuild the bathroom. They were also friendly and helpful.

The second contractor does both the mold removal and the rebuild of the bathroom. Evidently, this problem of mold from leaking pipes is very common as their whole business was just removing mold and rebuilding bathrooms from leaking pipes. They would deal with my insurance company directly. But, if the insurance company didn't pay, WE had to pay the contractor \$250 for writing up the estimate.

So we called our insurance company. They sent out a pipe inspector and an appraiser, who both agreed our pipes were leaking and we needed a new bathroom. The appraiser made an estimate, the insurance company subtracted our deductible, and a week later a check arrived in the mail. Now, it didn't cover the entire cost of a new

bathroom, since in their opinion we could re-use our tacky old vanity and tub (which the mold remediators couldn't remove from the bathroom without breaking it up), but it was a start. At least we didn't have to pay for the entire bathroom ourselves, and we could make another claim once we finished the bathroom and had the real costs (in the end we decided not to do that, since the original check did cover the basics and the additional costs were our own upgrades).

We hired the first mold remediation contractor, and they did an excellent job.



First, they put up a 10 millimeter plastic sheet with a zipper, to contain the dust and mold. And they brought in 6 millimeter plastic bags to contain all the debris that was removed.

Then they cut a hole in the bottom corner of the plastic sheet and inserted the hose of a sealed true HEPA vacuum. This created negative air pressure against the containment wall, so when it was opened, the air was pulled into the room instead of flowing out. The HEPA vacuum stayed on continuously during the entire two-day demolition.

After the tub, shower tile, and toilet were removed, we could see the extent of the damage. The post in the corner by the shower fixture was badly rotted, and the water had seeped through the plywood sub-floor for the entire length of the tub and almost all the way across to the other wall, four feet away. Under the toilet, there was also water damage.

Once the sub-floor was removed, we could see that some of the floorboards below were also saturated and needed to be removed.

When we looked at the plumbing, the problem became clear. Two of the galvanized pipes in the bathroom had corroded and were leaking: one to the toilet, and another in the shower. It would have cost less in the long run to have installed copper pipes in the first place. Copper pipes cost much less than an entire new bathroom.

Where there was mold on wood that hadn't been damaged, the mold was removed with a wire brush and HEPA vacuum. Then they wanted to apply a fungicide paint called **Fiberlock IAQ 6000**. "Oh, no," Debra said. But we had to weigh the toxic exposure with the possibility of a house entirely contaminated with mold. Debra took a look at the Material Safety Data Sheet, found that the health risk was rated very low, and let them apply it. But the fumes were more than she could tolerate. We ended up leaving the house for the afternoon and spent the night in a hotel, but once it dried, it was completely odor-free. Not something we would apply ourselves, though.

Though the whole process of mold removal was disruptive to our routine, and we were without a shower (we have a second toilet in the house, but only one shower), we both were able to breathe better immediately and were glad we began the remodel.

Then we got to have the fun of building a new bathroom! This was one case of lemons becoming lemonade—by remodeling we made our house healthier and got a beautiful new bathroom that we love.

## **OUR GOALS**

As a green building consultant, the first question Debra asks her clients is, "How green to you want to go?" And she finds out which aspects of "green" are most important to them.

"Green" is a general term that includes both environmental and health benefits. It can include resource efficiency—such as saving energy or water—to using natural materials, reducing toxicity, and integrating building with nature.

For us, it was mandatory to have a nontoxic bathroom, and anything we could do beyond that to help the environment, we would do to the degree it was feasible. We had budget constraints, and we wanted the style of the bathroom to fit within the context of our average suburban home that will one day be resold.

It was also important to us that the bathroom contain aspects of nature and celebrate the element of water. We wanted the bathroom to be a work of art that would bring us joy and lift our spirits every time we entered it.

Larry is what Debra calls an "artisan builder," in that everything he makes is both functional and beautiful. So we did all the design and building ourselves. What we saved in design and labor costs allowed us to spend a little more for materials. Labor turned out to be about 600 hours and the total expenditure on materials was about \$7000.

Most of the construction materials were purchased at Home Depot or Lowe's. If we are buying construction materials such as wood, we tend to go to Home Depot. If we are looking for something that requires style, we'll go to Lowe's first. But most of the items that required good design we purchased at Expo, the upscale home improvement store owned by Home Depot. Though our closest Expo is a two-hour drive, we found it was well worth the trip as they had much better design choices that were still affordable. Only a few items were purchased online or from local stores that carry green products.

## **THE "BEFORE" BATHROOM**

Before we ripped everything out down to the studs, our bathroom was the most horrible bathroom we've ever had. It was very small, only 5' x 8', plus a tub/shower.

The floor was covered with broken vinyl tiles, the vanity old particleboard, the fixtures and tile looked like they were probably the original from 1940 and leaking, the toilet was a water-guzzler. There was a tiny window, and no ventilation fan. The shower tiles were black and white and the ceiling, which was peeling, was painted Pepto-Bismol pink. Part way up the walls was some kind of old paneling with a fake tile pattern in it. We were using a cotton shower curtain that we had to replace every few months because it would mold.

## **THE "AFTER" BATHROOM**

What we have now is a charming bathroom that is water-tight, beautiful, and a joy to use. Every day we say, "We love our new bathroom!" Come take a look >>>



A mer-maid and mer-man made by a local artist point the way to the bathroom from the hall...

# THE SHOWER



The most important part of the remodel was to build the new shower correctly, so as to not repeat having to replace the bathroom because of faulty installation or lack of proper maintenance. Applying the green concept of durability, we wanted this bathroom to last and last.

Because of toxicity and aesthetic issues, we didn't want to use a fiberglass or acrylic molded shower. We wanted real tile. Rather than install another tub/shower combination, we decided to make this the "shower" bathroom and build another bathroom off the bedroom at a later date, turning it into a master suite with a "spa" bathroom with a beautiful bathtub.

Because we like to take showers together, and we couldn't both stand under one showerhead at the same time, we decided to make this shower the perfect shower for two. So we built the shower a little larger, with tile walls and floor, shelves for two sets of shampoo and soap and two showerheads.



We also installed a large clear skylight over the shower. It adds natural light during the day, saves electricity and gives a much more natural and spacious feel to our shower.

## **BUILDING A WATER-TIGHT SHOWER**

We were very concerned about installing the tile correctly so it wouldn't leak. Another leak would mean needing to rip out the bathroom and replace everything again. Correct construction would make the bathroom last many years and conserve the resources needed to replace it. Larry did a lot of research to finally find the correct way to install a tile shower. This knowledge seems to be becoming extinct with the new one-piece shower units. But we found it and our shower is absolutely water-tight.

Larry learned something while building the mortar base for the tiled shower pan.

Before you actually start mixing the mortar; make certain the directions you have are complete and with plenty of pictures of the important steps. Also, if it's written by someone who actually does lots of these tiled showers, that is best.

I started my shower pan project with a book not written by a tiling expert. The book had plenty of pictures and the instructions looked good except for one thing—the pictures and directions under the pictures did *not* match the text of the instructions. Someone had obviously taken instructions from two different sources and added them together. I had two different partial sets of instructions, both of them incomplete and useless.

I threw them away in frustration and threw out the mortar I had mixed. I then found *one* complete set with pictures that matched then I started again. The shower works and looks good now.

Read and understand the directions thoroughly before starting such a project that should make your shower pan project easier for you.

The instructions we used are at <http://www.debraslist.com/greenbathroom/showerpan.pdf>.

## **GLASS DOORS INSTEAD OF A SHOWER CURTAIN**

We installed glass doors on the shower to eliminate the need to use either a toxic plastic shower curtain or a moldy cotton curtain. We found it was much more cost-effective and less trouble to simply install the glass doors at the beginning than to keep buying expensive cotton shower curtains over and over.

Plus, Larry observed that the fact that we were using a shower curtain instead of glass doors actually was contributing to the mold problem. The shower curtain didn't keep all the water from the shower contained in the shower area, whereas the glass doors do.

Glass doors come in several degrees of sturdiness. The cheapest ones are pretty flimsy. The sturdiest ones are very expensive. We chose the next level up from the cheapest, which made a big difference in quality without costing a lot more.

The brand we purchased was **Sterling**, a Kohler company, which we found at Home Depot (it is also sold at Lowe's).

## **SHOWER MAINTENANCE**

The key to having a bathroom last for many years is to apply that old adage "a stitch in time saves nine" and perform regular maintenance to keep your shower water-tight.

Fix or replace any valves, pipes, or fixtures that are leaking. Make certain the water goes where it is *supposed* to go—down the drain, and not sitting in puddles on the floor.

Maintain good grout and caulk by removing and replacing failed or missing grout. Don't allow water to get where it shouldn't be. It will cause problems eventually.

Once your grout is all in good shape, seal the new grout with a nontoxic grout sealer, such as **AFM Grout Sealer**. This will help the

grout last longer and function better to keep the water where it ought to be.

Any loose or broken tiles should be replaced and regouted and resealed right away before the problem has a chance to grow. Be sure to keep on hand some tiles from the original lot so you will have matching tiles for replacements.

Keep your shower clean and in good repair and you can enjoy it for many more years.

## **PLUMBING DOOR**

One of the things we didn't include in this bathroom, but wanted to mention anyway, is the idea of a plumbing door, which is an opening with a door on the back side of the wall that holds the shower plumbing. This allows you to get in and make repairs if necessary, rather than ripping the whole wall of tile out in the shower. If we had such a door in this bathroom, we could have checked the condition of the pipes and found the leak more easily. Ripping out a wall of tile and disabling the only shower in the house makes one think twice before taking this action.

If you are doing new construction and can design this feature in, we highly recommend it. Though it wasn't feasible here, when we did the bathroom remodel in our house in California, which had a shower that popped out of the room into it's own alcove, we were able to design in a plumbing door that we could access from the outside.



# TILE & MARBLE



We used a lot of tile in this bathroom because we wanted all the floor and wall surfaces to be watertight.

One of the things we love to do is visit historic houses when we travel. We were inspired to tile seven feet up the walls all around the room after visiting Ernest Hemingway's house in Key West, Florida. His bathrooms are all tiled floor to ceiling, as are the bathrooms in many other historic homes.

The modern motivation of choosing cost over durability has led to using less and less tile in bathrooms, and less protection from moisture. Of course, it ends up costing more in the long run because bathrooms then need to be replaced more frequently.

We opted to build a "durable" bathroom instead of a "disposable" one, and that required more tile.

## **BUYING TILE**

Tile is not cheap, and we had budget constraints. We had to be creative.

One expenditure we made that we were very pleased with was a wet tile saw. Because we had so much tile to cut, it was essential. Fortunately, we found an

inexpensive one at Home Depot that was on special one weekend. Around pipes or corners where we had to cut tiles the wet tile cutter was excellent. Fast, dust free and exact cuts. We've found that it always pays to have the right tools. If you don't want to purchase a wet saw, they can be rented at many rental or even home improvement centers.

When looking for tile, we first went to our local discount tile close-out centers. These places have leftover and returned and overrun tiles at greatly discounted prices. We have been able to find very high-end and even recycled tile at huge savings. But they don't always have what we want in terms of design and color. If you really need to save money, check out some of these places, choose a tile, and design around it.

We also suggest buying tile at architectural salvage yards. For our bathroom in California, we just happened to come across a whole crate of high-end handmade tiles in a salvage yard that had never been installed. We bought the whole crate, enough for our entire shower and floor, for \$80. When I took a piece into a fancy tile store looking for accent tile, the saleswoman said, "Oh, did you buy that here?" They were selling the same exact tile for \$15 a square foot.

You can save a lot of money buying this second-hand tile and help the environment too. We considered using tiles with recycled content, but the cost was way beyond what we could afford (we did use leftover recycled tile as accent tile in the rental house we are remodeling, but couldn't find any that went with the color scheme in this bathroom).

After looking around at a lot of tile options, we decided to use the cheapest white field tile that we liked and splurge on accent tiles. We bought boxes and boxes of plain white "subway" (3"x6" rectangular) tiles at Home Depot, then chose white accent tiles with a wave pattern.



We tiled all the walls of the bathroom as one room, including the shower enclosure. Instead of limiting the field and accent tile to the shower area only, we tiled the entire room up to seven feet on the walls with the same tile. What separates the shower from the rest of the room are the glass shower doors and different tiles on the floor of the shower.



We also purchased some "crown molding" tile to put around the top of the tiled area all around the room. We wanted to create an effect that the bath "room" was the tiled area, with a "blue sky" ceiling above.

On the floors, we used one tile pattern for the main bathroom floor and another for the shower floor.

For the bathroom floor we chose one-inch hexagonal tiles because we always admired them whenever we walked into old bathrooms. We made a black hex tile border and randomly scattered grey-and-black hex "daisies" among the white hex tiles that filled in the center. We chose white, grey and black tiles because they coordinated with the white and grey marble



baseboards we used throughout the bathroom and shower. It was also a historic connection to the black and white tile originally installed in the bathroom in 1940. We thought these tiles would be much more expensive than they were, which taught us the lesson of actually pricing out what we really wanted and not making the assumption we couldn't afford it.

For the shower floor, we wanted something entirely different. We wanted to feel like we were entering "the world of water" when we



stepped into the shower, so we wanted tiles that had the character of water. We chose iridescent green and blue one-inch square tiles and some silver tiles to give the feeling of light bouncing off the water. Because these iridescent tiles cost so much more, we

used mostly plain white one-inch square tiles (which, like the hex tiles were surprisingly afford-able), using the colored tiles like “drops” of water on the white floor. We chose to tile our shower floor because tile is nontoxic, beautiful, durable and, for us, a creative fun project.

## MARBLE

We used marble for the baseboards. While this may seem extravagant, it actually wasn't. Here in Florida, home improvement stores sell inexpensive marble strips for windowsills because the humidity rots wooden sills very quickly. We used the six-inch strips for the baseboards and, the door threshold, and to cover the foundation below the shower doors. They look beautiful and are water-tight.

Larry used leftover pieces of marble to make little shelves in the corners of our shower to hold our shampoo and soap—very elegant recycling—and also



to make little detailing pieces, such as accommodations for where the placement of pipe fittings didn't quite match the placement of baseboards.

Most of the marble baseboards for our bathroom were purchased for a total of \$15. We found pieces in the rack that were damaged or broken on one or both ends, but still long enough for our needs, and took them to the store manager, who gave us a deal on the whole lot. Home improvement stores will often give you an excellent deal on slightly-damaged or opened cartons, but you need to ask for it first.

Since we had purchased the wet saw to cut the tiles, we knew we could cut the marble any length we wanted and we did. Larry also used the saw to bevel the top edge of the baseboards—tricky, but possible, and worth every minute because it adds a very custom, elegant touch. Rough cut edges or bevels should be sanded with a hand sander to achieve an almost perfectly smooth bevel. The bevels make all the marble look great, and expensive.

## **INSTALLING TILE**

The basic procedure for installing tile is to install an underlayment material so you can have a flat, strong, nonflexible surface to which the tile can adhere, then apply thin-set mortar (this is mortar formulated to be applied in a thin layer, rather than a thick one) that holds the tile to the underlayment. Once the mortar dries, grout is applied between the tiles, and then a grout sealer is applied. All in all, a nontoxic installation.

We purchased all our tile installation materials at Home Depot. All very standard.

Any standard cement backerboard is fine. We used **DUROCK® Cement Board** in this bathroom, but we have also used **Hardibacker** in other bathrooms in the past. There is also **Wonderboard**, which was the first product of this kind. Cement backerboard has a solid concrete core and is faced on both sides with fiberglass mesh just under the surface, making it the best choice for wet areas like shower walls and bathtub surrounds.

For tiling in a wet area, do NOT use water-resistant drywall or "greenboard." It falls apart when it gets wet—similar to regular sheetrock—as the coating is only water-resistant, not water-proof.

We used 1/4" DUROCK® Cement Board on the floors for a tile foundation, and 1/2" on the walls to closely match the existing plasterboard depth. We put the DUROCK® Cement Board for the floors over the 1" plywood and pine sub floor.

We taped the DUROCK® Cement Board with fiberglass mesh tape, and covered it with thin-set mortar. We also covered the screw heads with thin-set to prevent leaks. So it is very water-tight.

To lay all the tile and marble, we used **Custom Building Products Marble and Granite Mortar Mix**, not the toxic adhesive you sometimes see used to set tiles. We also added their **Acrylic Mortar Admix**. Though the admix is a plastic that is not renewable or biodegradable, and it has a slight odor, the odor dissipates when dry and it is also blocked by both the tile and the grout. We chose to use the admix because it makes the mortar stronger and more flexible, making it less likely to crack. In this case we weighed the pros and cons of using the additive versus replacing the bathroom if the mortar cracked and decided the greatest good was to use the additive. We used the white thin-set mortar designed for marble for both the marble baseboards and the floor tiles because we needed to use it for the marble anyway.

Larry has some tips for laying a shower floor with a custom pattern:

After the shower floor base was constructed and ready to tile, and before we put down any thin-set mortar to hold the tiles, we laid out the sheets of tile on the shower floor to work out the design we wanted. These 1-inch square tiles come in sheets that are 1'x3' sections, held together by a mesh grid on the back.

It was fairly easy to cut out the meshed white tiles to leave space to insert the colored ones where we wanted them. Just be sure to cut the mesh close enough to the tiles' edges to allow space for the new tiles to actually fit well.

After we worked out the design this way, we transferred all the shower floor tiles to several large pieces of stiff cardboard and reassembled them out of the way in the hall. This way we could pick up a large section of tiles on the cardboard and simply transfer the tiles to the shower

floor one section at a time. *Don't install the cardboard under the tiles.*

We installed the shower floor tiles in thin-set mortar one section at a time being aware to maintain our design pattern and the proper spacing between the added color tiles. The white ones have a mesh backing that keeps the spacing uniform, but individual accent tiles don't, so you need to maintain the spacing correctly by hand. Also, it is best to use tiles of the same size and height. Unfortunately, some of our colored accent tiles were thicker, so I needed to monitor the thickness of the mortar to make the floor relatively smooth. More mortar goes under the thinner files so they match the height of the thicker ones.

I pressed the floor tiles into the mortar a bit so they would be securely held in place by the thin-set mortar. If tiles are pressed down too much then mortar will squeeze out above the level of the tiles and you will have no room for the tile grout later. So *before* the thin-set hardens into stone, make sure you still have space to grout between the tiles.

Take extra time and care installing tiles around the shower drain. Some tiles will need to be cut to fit around the drain and you want the water to drain so the shower drain needs to be just ever so slightly below the level of the finished tiles. You don't want a puddle of water standing around the drain, which is what you get if your drain isn't a bit lower than the tiles.

I continued this process, mixing enough thin-set mortar for one section of tiles at a time, 1'x3' of tiles, then installing the tiles per our design.

Any extra mortar between tiles or spills needs to be cleaned up as you go. It is about a thousand times easier to clean it before it hardens.

After the mortar dried thoroughly, we began grouting the floor tiles. We used snow white grout because we liked how it looked with our tiles, and also because a darker grout would make it harder to see any mold or mildew. We used **Custom Building Products Polyblend**

**Non-Sanded Grout** and **Sanded Grout** (because we had different widths of spaces between the tiles and marble pieces), but any brand of grout suitable for shower tile installation is fine. This brand came with a latex additive already in it. You can also get grout without the latex additive, however, we chose to use it for all the same reasons we chose to use the acrylic additive in the mortar.

After we thoroughly cleaned the grout and allowed it to dry, we applied **AFM Grout Sealer**. We loved this grout sealer! It did not smell horribly like many other grout sealers, and was incredibly easy to use. Larry says, "Well done, AFM, for giving us such a great product!" Using a grout sealer increases the life of the grout and makes it easier to clean. We had been avoiding using grout sealer in past installations because most are so toxic, so we were thrilled to find this excellent water-based grout sealer.

All the tile in this bathroom looks great! And the white subway tile at Home Depot is so inexpensive, it was only a few hundred dollars more to buy enough tile to cover all the walls instead of just the shower enclosure.



# PLUMBING & FIXTURES



To fix the plumbing leak that led to the bathroom replacement, and to prevent new leaks, we replaced all the old galvanized pipe with new copper pipe, installed with lead-free solder. Because we wanted to make sure it was installed absolutely correctly, we hired a licensed plumber to install it. This, and the electrical, were the only parts where we hired subcontractors, the rest of the work we did ourselves.

All of the fixtures in the bathroom—sink, toilet, and shower—are low-flow. We had no problem finding these everywhere fixtures are sold.

## TOILET

We replaced our old 5+ gallon flush toilet with a new 1.6 gallon flush toilet. We checked *Consumer Reports* magazine for best flush results in low-flow toilets and bought one of the **Eljer** models with best results per flush. It doesn't save much water if you get an inefficient model you have to flush two or three times to get it fully flushed.

Our county also has a toilet rebate program that rebates a substantial portion of the cost of a new low-flow toilet if it replaces an old water guzzler type. Check with your county for this. We had a similar

program in California where we used to live. We're sure other counties do also.

We didn't want a plastic toilet seat, so we purchased one made of wood. We found one made of oak at Lowe's, but decided to get a bamboo toilet seat made by **Bemis Manufacturing** that we found at Home Depot's Expo store.



## **SINK FIXTURE**

There were many many low-flow sink fixtures to choose from, in all price ranges. Our bathroom has an old-fashioned look, so we wanted a sink fixture with that feel. We wanted cross-bar handles with porcelain "H" and "C" inserts for hot and cold.



We looked at Lowe's and Home Depot, but didn't like any of the styles. Home Depot's Expo store had styles more to our liking, ranging from slightly more expensive to high-end designer. The fixture we chose made by **Pegasus** didn't cost much more than the fixtures at Home Depot and Lowes, but had a lot more character.

Though we had constraints to our budget, we weren't looking for "the cheapest thing." We were looking for design elements that were beautiful to our eyes and would bring us joy when we used them, and made those choices as best we could without going overboard on cost.

## **SHOWER FIXTURE**

Here we also spent a little more money to get exactly what we wanted.

When we went shopping, we found that there are many new features in fixtures now, since everything has been redesigned to be more

water-efficient. One of these features on shower fixtures is a pre-set temperature control that allows you to set the temperature you like, and then whenever you turn on the water, it goes to exactly that temperature. This eliminates using up water while adjusting the temperature. We saw this in an upscale hotel we stayed at, and fell in love with it. Debra said, "THIS is the fixture I want in our bathroom!"

We didn't get that exact fixture, but we got a more affordable fixture with that same feature made by **La Toscana**, at Home Depot's Expo store. Though we chose an old-fashioned style for the sink fixture, we went with modern for the shower fixture. It just seemed to go with the water-theme tile. We like eclectic style, so we didn't feel that all the fixtures had to match. When we are in the bathroom, we don't see the shower fixture, and when we are in the shower, we don't see the sink fixture, anyway.

We installed two low-flow showerheads in our shower. We weren't particularly impressed with the showerhead that came with the La Toscana fixture set, so it was fortunate that each piece could be purchased separately and mixed and matched. We chose showerheads that had a style we liked, made by **Hans Grohe**, at Home Depot's Expo store.

Apparently there are major differences in how low-flow showerheads are constructed. Some are just regular showerheads with flow-restrictors. Others are newly designed to be more water-efficient. We're very happy with the showerheads we chose as the result of a knowledgeable salesperson helping us make our selection.

While shopping for fixtures, we went to several very high-end plumbing "galleries" where everything was far too expensive for us. But we learned a lot about what was available. They had, for example, sinks set up with the showerheads so you could feel the spray and understand the differences. The brand we bought was actually very highly recommended by both the high-end galleries and Home Depot's Expo store.



Now, since two showerheads may sound extravagant, we want to explain how we installed them. Instead of having two pipes with two independent fixtures, we have only one pipe and one fixture with a diverter valve that allows one or the other or both showerheads to be on as we choose (the diverter valve was also from the **La Toscana** line, which has all kinds of pieces to construct any arrangement of showers and jets you want). When we turn the diverter valve from one showerhead to two, the water pressure goes down because the same flow of water is now divided between the two showerheads.

We often save water showering together. The water in the pipes only needs to heat up once instead of twice if we both take a shower at the same time, and besides, it's friendlier. It's still one showerhead per person, per shower, and there's someone there to wash your back.

## **WATER QUALITY**

Debra has been purifying the water in her shower since before we met. In 1978, her father invented the first shower filter for her by attaching a simple undersink carbon filter to her showerhead.

Tap water contains so many toxic substances that can be absorbed through the skin that we feel it is vital for shower water to be purified. So much so, that we invested in a whole-house water purification system from **Go Beyond Organic**, which removes chloramines, fluoride, and many other chemicals. This ensures that all the water we use in our home—including the water in our shower, from the sink fixture when we brush our teeth, and even in the toilet, is free from volatile toxic chemicals.

If a whole-house filter isn't feasible, we recommend at least attaching a showerhead filter, which are available online for \$50 or less.

## VANITY & MEDICINE CABINET



Our vanity is solid wood. We found it at Home Depot's Expo store, on sale.

The sink—also purchased at Expo—is porcelain through-and-through. Unlike porcelain-covered iron or steel sinks, it will not rust if chipped, and therefore is more durable.

We also found a medicine cabinet at Expo with a 100% stainless steel case—a simple design with a lovely beveled mirror—made by **Broan-Nutone**. Home Depot and Lowe's carried only



medicine cabinets made of particle-board or plastic.

We considered reclaiming an old piece of wood furniture for the vanity, but the area was so small, when we saw this vanity on sale we decided to go with this one.

## PLASTER & PAINT



Because we tiled the walls up to seven feet, we only needed to paint the walls above the tile and the ceiling.

We considered many different nontoxic and natural paint options, and then decided to use natural colored clay plaster from **American Clay**. It is nontoxic, does not ever need to be repainted (you can just patch it up if necessary by applying more plaster), and since it breathes better than painted surfaces it is actually a good choice for bathrooms because it helps control humidity.

And since the original walls from 1940 were plaster, and are plaster throughout the house, applying colored plaster kept that consistency.

The plaster was just a joy for Larry to work with, instead of paint. It was a bit of a challenge to get the color mix to just where we wanted it, but eventually we got this beautiful, almost sky-blue color. And we love the variation of hues in the textured surface in contrast to the flatness of color on a painted surface. And the plaster was a lot nicer than latex paint to install because there were no fumes at all.

The colored plaster is applied to a sound wall with a trowel over a special sand tooth primer. This is akin to the old style lath and plaster construction. It was more work initially, but lasts much longer than typical sheetrock and paint in a bathroom.

We did use a bit of **AFM Safecoat Transitional Primer** on the wood trim around the door and the door itself (and on the areas to which we applied the colored plaster) followed by **Eco-Spec Paint** from **Benjamin Moore**. Though there are less toxic and more natural paints available, it was a small area and this paint is easily available to us locally.

# LIGHT & VENTILATION



A large amount of moisture is generated in a bathroom each day, which can result in the growth of mold and mildew on bathroom surfaces as well as in wall and ceiling cavities if the room is not properly vented. Mold can create respiratory problems and require costly replacement of materials, or even an entire bathroom, as we experienced.

Ventilation is very important because it controls excess humidity.

Humidity is about the amount of water vapor present in the air. Relative humidity is the percentage of water vapor in the air compared to what the air can hold at that same temperature. The humidity scale is measured as a percentage on a scale from 0 to 100. At 100%, water vapor fills 100% of the air and condensation occurs. At 0%, there is no water vapor present and the air would be extremely dry. In a steamy bathroom, it is easy to observe that humidity reaches 100% by looking at the foggy condensation on mirrors, windows, and tiles.



The amount of moisture that the air in your bathroom can hold depends on the temperature of the air. As the temperature goes down, the air is able to hold less moisture. Cool bathrooms can hold less water in the air; warm bathrooms can hold more.

High relative humidity, over 50%, encourages biological agents--such as bacteria, viruses, and molds--to grow and be released into the air. If a bathroom continuously has high humidity, obvious mold growth or a mildew odor will be noticeable.

Mold spores can easily enter the bathroom by circulating through doorways, windows, heating, ventilation systems, and air conditioning systems. Spores in the air can also land on people and animals, who can bring them indoors as well. But mold only becomes a problem in areas where it can proliferate because of excessive moisture.

The key to controlling mold in a bathroom is to control the humidity and the key factor in controlling humidity is ventilation.

Our old bathroom was not vented at all. It had only a small window that didn't give much light, and even though it had translucent glass, the window was placed in such a way that our neighbors could see in from waist-level up if we opened it for ventilation. So we decided to remove that window entirely and completely rethink light and ventilation.

For ventilation, we chose a combination light fixture and vent, which vents moist bathroom air outside with a fan and duct and provides an overhead light. We chose "Ventura," made by **Hunter**, which we found at Lowe's, because we loved the way the light came out around the edges like little sunbeams, and it also provided the correct amount of ventilation for our bathroom without making too much noise. We put the light and fan on separate electric switches so we can use one without both fan and light being on. Set up this way we use only what we need, and save electricity. We made sure that the vent exhausted to the outside of the house and not to the attic.

Heat will also evaporate humidity. A small space heater or wall heater will warm the room and dry up any dampness left over from a shower. An overhead heat lamp will help dry the room too (and is a luxurious way to dry your body after bathing). While we didn't install these in our bathroom, they are other possibilities.

## ADDITIONAL LIGHT

Adding plenty of windows and skylights to a bathroom is a beautiful way to provide natural light and control humidity and mold at the same time. Mold won't grow where there is light and the additional warmth with help dry the room.



We installed a large skylight over the shower. This gives us both light during the day (right over the shower where there is the greatest moisture) and an excellent view of oak tree branches overhead, sunbeams, and raindrops.

Be sure to check with local building authorities before purchasing windows for the bathroom. There may be regulations for the type of windows and glass installed in shower and bathtub areas, as we found out after purchasing a beautiful window for our shower that we were not able to install, because of building code restrictions in bathrooms.

For vanity light, we used inexpensive "Hollywood" lights, as these were much more affordable than most other fixtures and gave the best task light. We really searched for vanity lights and were surprised to find that most decorative fixtures, in addition to being expensive, just didn't provide enough light. So we chose what was practical, simple, and affordable.



# TOWELS



The towels actually presented an unexpected design challenge. Generally we have lived in houses where the bathrooms were constructed by others and fairly neutral, so we could just go to any store, choose towels in any color we liked, and they would be fine.

But this bathroom had a water theme, and the blue had to be defined by the color of the plaster, because that was limited to the natural pigments available. So we had to find towels that didn't clash with that blue.

This was more difficult than we anticipated. Of course, we could have

chosen towels with green benefits—made from organic cotton or bamboo—but we couldn't find the right color. Debra kept going to stores and bringing home washcloths of different blues, but all were wrong and she would return them. Finally, she found these 100% cotton towels at Bed, Bath & Beyond, and we also got plain cotton terry bath mats in matching colors. In this case, the spiritual benefit of aesthetics won out over the physical environment benefits.

The towel bars are brushed nickel, in a modern style that coordinated with the shower fixtures. They were made by **Perfect House**, a Home Depot house brand, sold at Home Depot.

# STORAGE

Storage was a challenge in this small bathroom, as there just wasn't space to put a cabinet or a spacious vanity.

Our solution was to pare down the essentials that needed to be stored in the bathroom and then be creative.

The vanity has one drawer with two compartments, so we use that for little things like brushes, combs, tweezers, and other small items we use all the time. It also has a cabinet area below where we store cleaning products, hair dryer, and other personal items that need to be within reach.

The medicine cabinet holds body care products and things like cotton swabs.

Additional rolls of toilet paper are stored on a vertical toilet paper stand kept right next to the toilet.



For a waste basket, we use a covered wicker basket that we've had for years. Debra bought it from a friend who was selling it at a garage sale. We really like that it has a top that closes so the trash isn't visible.

On top of the toilet we have various receptacles to hold things. A wicker box holds Debra's cosmetics and a glass jar holds her handmade soaps.

We didn't have space for a shelf to hold towels, so we hung them all on the wall. We decided that six towels were plenty if we kept washing them, and they add a softness to the room that is mostly hard tile.

We have a box in the hall closet marked "bathroom" for anything else that doesn't fit in the bathroom, and we also store our toilet tissue there, which we buy in bulk.

# BODY CARE PRODUCTS

Though these are not part of constructing a green bathroom, we feel that if one is going to have a green bathroom, everything used in it should be green too.

Our body care products are very simple and always natural, and made with organically grown ingredients when possible. We don't want to put petrochemical-derived ingredients on our skin or into the environment.

We don't use a particular brand of soap, but rather choose from our storehouse of soaps we've collected over the years. At various times we've received or purchased whole cases of natural machine-made bar soap, and Debra buys various handmade soaps at farmer's markets and craft fairs and when we travel. Larry is working on using up the accumulated machine-made soap and Debra generally uses the handmade soap. She likes the varied natural fragrances and textures and the fact that they are "whole" soaps in that the natural glycerine produced in the soapmaking process is retained and not removed.

We also use a variety of different shampoos as Debra is trying different brands all the time. All are at least natural, some are organic.

Larry has a beard, so he doesn't shave except to trim his beard with a little electric trimmer. Debra uses a razor and her handmade soap in the shower.

We're also always trying different natural toothpastes.

Debra has a favorite natural lavender deodorant, Larry uses plain baking soda.

# CLEANING

We use very few products to clean our bathroom.

To clean the toilet, we simply sprinkle **Bon Ami Polishing Cleanser** in the toilet, clean with a toilet brush, and flush.

We clean the sink with Bon Ami and a cellulose sponge.

Our mirror gets cleaned with a solution of half-and-half vinegar and water in a spray bottle, or, often we will just wipe it clean after a shower when it's all fogged up, with a towel destined for the laundry.

We use undiluted distilled white vinegar on our glass shower doors to remove mineral deposits left by water drying on the glass doors. Spray on the vinegar and rub it with a sponge, then rinse and dry with a towel. Be careful not to get vinegar on limestone or marble surface and it may tend to etch or damage these natural stones (limestone and marble are the same "mineral deposits" the vinegar is removing from the shower door).

We usually just vacuum the dust off the floors, but if we need to clean them, we use plain soap or baking soda.

If you do a good job at controlling humidity, you may never need to clean mold again! But if you do, just mix borax and water in a spray bottle, spray it on, and the mold will wipe right off with a sponge. Or, you can clean it with hydrogen peroxide.

If mold is really a problem in your bathroom, keep ahead of mold growth by drying any damp surfaces before mold can grow. After each shower, dry the walls and floor of the shower stall plus any other wet surfaces in the bathroom.

Fabric items tend to hold water and host mold--cotton is particularly prone. Do not install carpeting in the bathroom. Wash bathmats frequently--damp bathmats left to sit on the floor will begin to grow mold. Make sure towels are hung to dry or laundered. Pull cotton shower curtains outside the tub to dry, and wash frequently to prevent mold growth (or, better yet, install glass doors).

# NATURE



From the beginning of our plan, it was very important to us to celebrate the element of water in our bathroom, and to connect the room to nature.

The most dramatic feature in this regard is the skylight over the shower, in addition to the sky-blue ceiling. At certain times of year, the sun shines down right into the shower at midday; at other times, sunbeams are caught by the beveled glass in the medicine cabinet mirror and reflect rainbows on the walls (an unexpected delight!). Because of the skylight, the room always has light during the day, and it is always changing depending on time of day and time of year. It really feels like an outdoor shower because of the skylight.

We intentionally opened up the ceiling over the shower so the light would be coming in directly from the roof and not down a shaft in the dropped ceiling. Opening the ceiling over the shower and not in the entire room further defines the shower as a separate space.



Our overhead light shines like the sun while at night, our night light illuminates a moon.

We also used nature details, including sea shells, two sea "stars" (starfish) hung in the blue "sky," and a decorative tile with two leaping dolphins that looks like it comes from an ancient ruin.

Every time we enter our bathroom, these details remind us that we are, indeed, a part of the whole of nature.





# DIRECTORY OF PRODUCTS USED

Clay plaster: **American Clay**  
<http://www.americanclay.com>

Medicine cabinet: **Broan-Nutone**  
<http://www.broan.com>

Mold Paint: **Fiberlock IAQ 6000**  
[http://www.fiberlock.com/pds/iaq\\_6000\\_pds.pdf](http://www.fiberlock.com/pds/iaq_6000_pds.pdf)

Paint: **Benjamin Moore**  
<http://www.benjaminmoore.com>

Primer: **AFM**  
<http://www.afmsafecoat.com>

Sink faucet: **Pegasus**  
<http://www.pegasusinfo.com>

Shower doors: **Sterling**  
<http://www.sterlingplumbing.com>

Shower faucet: **La Toscana**  
<http://www.latoscanacollection.com/Pages/thermostatic.html>

Shower head: **Hans Grohe**  
<http://www.hansgrohe-usa.com>

Tile grout: **Custom Building Products**  
<http://www.custombuildingproducts.com>

Tile grout sealer: **AFM**  
<http://www.afmsafecoat.com>

Tile mortar: **Custom Building Products**  
<http://www.custombuildingproducts.com>

Tile underlayment: **DUROCK® Cement Board**  
<http://www.cgcinc.com/home.asp?nav=156&mkt=30&bc=1.48.156>

Tile underlayment: **Hardibacker**

<http://www.jameshardie.com>

Tile underlayment: **Wonderboard**

<http://www.custombuildingproducts.com>

Toilet: **Eljer**

<http://www.eljer.com>

Toilet seat: **Bemis Manufacturing**

[http://www.bemismfg.com/pressreleases/release\\_20050425\\_02.php](http://www.bemismfg.com/pressreleases/release_20050425_02.php)

Ventilation fan: **Hunter**

<http://www.hunterfan.com>

Water filter: **Go Beyond Organic**

<http://www.gobeyondorganic.com>