



**SURFACE PREPARATION  
AND COATING**

# Drying and Coating Concrete at the National Aquarium



**Property Damage  
Restoration**



**Temporary  
Humidity Control**



**Property Performance  
Services**

**After several years of wear, the coatings on the famous Atlantic Coral Reef Tank and the Open Ocean Shark Tank at the National Aquarium failed, allowing sea water to penetrate the concrete. The tank linings were replaced in order to protect the reinforcing steel from corrosion, which would have weakened the concrete structure.**

To improve the replacement coating life, the engineering consultants selected a five-part lining system, including primer, epoxy undercoat, fiberglass matting and two top coats. To ensure good adhesion between the concrete and the primer, the consultants specified a maximum moisture content for the concrete. Drying the concrete was left to the contractor, who used Polygon to ensure that specifications could be maintained at all times.

## The Problem

In lining duty, nearly all concrete coating systems have been known to fail prematurely. Coating manufacturers identify excess moisture as a contributor to these failures in two ways. First, surface moisture prevents the primer from bonding and curing properly. Then, as the concrete warms during hot weather, heat drives the concrete's interior moisture into the coating from behind. This disbonds the primer.

Such problems can be avoided by drying the concrete before coating. But to achieve the low moisture content required, the air above the surface must be dry. That way the air can absorb the moisture as it is released by the drying concrete.

Also, during humid evening and morning hours, amine epoxy coatings will react with atmospheric

CO<sub>2</sub> when moisture is present to form a thin layer of "blush." This surface contamination interferes with adhesion unless it is removed before the next coat is applied. Polygon's all-season climate control proved to be the solution for both drying the concrete and for avoiding the occurrence of blush.

## The Solution

The contractor, Structural Preservation Systems Inc., evaluated several alternative proposals. Polygon was used because the proposal reflected experience in drying sea water tanks at other aquariums. The contractor's initial confidence was well placed. Steve Mainello, the project manager for SPS explained, "Polygon had the technical understanding of what equipment we would need, and they worked with us week-by-week as those needs changed. Polygon's fast response and their flexibility made me feel like I was their most important customer."

On-site logistics were a particular challenge because the aquarium is located on a short pier, with essentially no space around the building for climate control equipment or for generators. Polygon provided a solution with equipment small enough to use on-site power and light enough to be placed on the roof. Dry air was brought through flexible hose down into the tanks. Duct runs of more than 100 ft. were common as the requirement for dry air moved throughout the building.

The contractor accelerated drying time using heaters in combination with dehumidifiers. However, care was taken not to over-dry the concrete in the process of combining the technologies.



At the National Aquarium in Baltimore, Polygon helped the contractor dry out wet concrete quickly, improving adhesion and keeping the project on schedule and on budget.



# Case Study: Drying and Coating Concrete at the National Aquarium



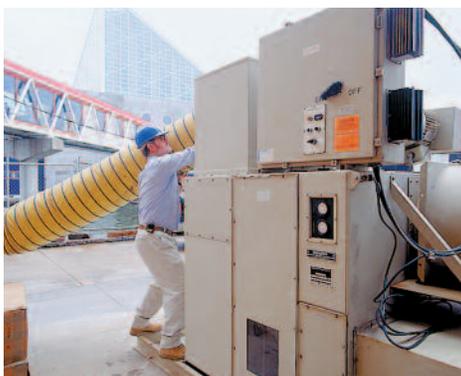
The moisture content of the concrete was measured throughout the tank using the equilibrium moisture content method. By quantifying and monitoring the concrete moisture content continuously, the drying process could be tracked section-by-section. Dry air and heaters were repositioned often because parts of each tank dried more quickly than others. This technique allowed the use of smaller, more cost-effective dehumidification equipment than had been used in the past for concrete drying.

After instruments read 75% RH in all the holes drilled for moisture measurement (about 5% moisture in the concrete), the coatings were applied. Polygon desiccant dehumidifiers were then used to keep the dew point 20 degrees below the surface temperature, while each layer cured. Without that level of dryness, atmospheric humidity can exacerbate the coating's reaction with CO<sub>2</sub> to form the familiar amine "blush" that interferes with adhesion. With the Polygon equipment on the job, amine blush was not a problem.

As cleaning, blasting and coating operations moved from tank to tank, humidity control requirements changed. Polygon's flexible



Handling a difficult site problem — normally, large dehumidifiers would have been used to dry the 130,000 cu. ft. tank at Baltimore's National Aquarium, but limited on-site space required a more flexible solution. Polygon's versatile fleet provided combinations of lighter and smaller dehumidifiers which could be positioned in available locations.



Yellow duct delivers the required dry air to lower levels.

approach recognized this reality, helping to keep costs down without risking coating quality. Steve Mainello explained: "Polygon would bring in additional equipment and accessories as we needed it, and allow the equipment to go off-invoice when we finished with it, even if it was still on the site. That trusting attitude and fast response really helped the job go easily. I could always count on Polygon — they were always there when I needed them. Our overhead on this job was \$5,000 per day, and the project lasted about seven months. Polygon's reliability has saved us at least a week over those months, which means we've saved tens of thousands of dollars."

## The Benefits

### Tens of Thousands of Dollars Saved

Keeping on schedule in spite of wet concrete and the exceptionally humid weather, Polygon allowed operations to go uninterrupted — downtime would have cost \$5,000 every day.

### Fast Drying of Concrete

Excess moisture was removed from the 130,000 cu. ft. concrete tank in less than three weeks. The smaller pretreatment tanks were dried in four to six days. Fast concrete drying keeps projects on schedule, ensuring profits for the contractor and improving job quality for the owner.

### High-Quality Coating Adhesion

With no excess moisture in the concrete, the primer adhered firmly to the tank surface, so the primary mechanism for lining failure was held in check.

### Flexibility to Fit the Need

Polygon made sure the right equipment was ready at all times. Extensive inventory and ability to modify equipment made sure that the job could proceed under humidity control in spite of the unusual site limitations.

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