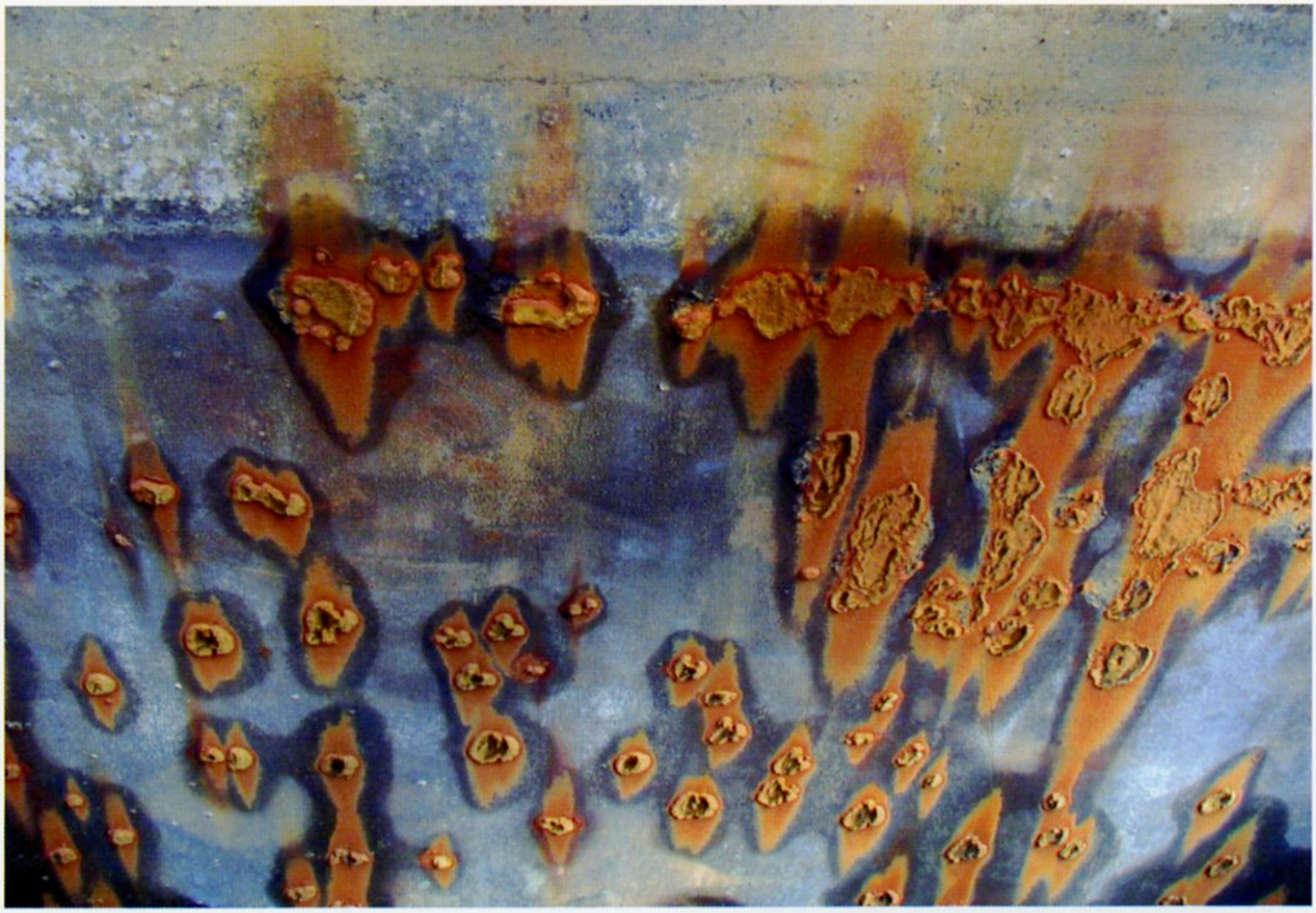
John Robinson

DURABILITY & LIABILITY



Rapid microbiological corrosion in a cooling tower water tank for a boiler used for steam generation for a high-technology autoclaving operation caused rust staining of the product being autoclaved. The owner took action against the boiler manufacturer resulting in lengthy and costly litigation.

INTRODUCTION

As well as being the editor of Corrosion Management magazine for 15 years, I have my own consulting business (Mount Townsend Solutions) that also exposes me to a wide range of issues associated with the performance and durability of materials of construction ad their protective coatings.

An alarming fact that has emerged from this experience is that incorrect selection of materials or their protective coatings can have cost consequences for the specifier or supplier that far outweigh the value of the original product.

In many cases, decisions made with good intentions but with lack of product knowledge, can lead to litigation that gives rise to remediation claims for costs that are an order of magnitude greater that the original product is worth.

LIABILITY

There is no longer a statute of limitations on defects arising from incorrectly specified products on building and construction. Plaintiffs can pursue the supplier to the grave if necessary, to recover the costs of faulty materials or workmanship. For this reason, few of us in the specifying professions would be without our expensive professional indemnity insurance and other businesses insurances to protect our businesses and personal fortunes.

Even when specifications are adequate for the intended application, litigious end-users can make claims that incur expensive legal costs in defending the supplier against what are essentially unreasonable and mischievous claims for damages.

CASE HISTORIES

The following case histories in which I have had a personal involvement illustrate the costly consequences of deliberately or inadvertently providing a service or product that does not deliver the perceived performance required by the end use.

Case 1

Steel lintels were installed in a three-storey block of beachfront units on the central coast of NSW. The environmental classification according to the Lintel Durability Standard (AS 2699.3) was R4, requiring a specific paint coating standard appropriate to a severe marine exposure classification.

The lintels started corroding within 2 years of installation. The builder had issued a specification in accordance to AS 2699 for coating the steel lintels. Testing of the coating system revealed that contractor who painted the lintels had primed the steel with a cheap metal primer on a lower standard of surface preparation, rather than the epoxy zinc-rich paint and Class 2 ½ abrasive blast specified. The cost saving was less than $1000. Estimated repair cost to remove and remediate the lintels: $200,000.

Case 2

A dwelling located in the Gosford area of NSW, built on a sloping site, had steel framed flooring system and supporting columns. The flooring system and supporting steelwork was manufactured from continuously galvanized tube which has a zinc coating thickness of approximately 20 microns. The location of the dwelling was about 400m from a salt water estuary and about 8km from the ocean surf.

The owners took legal action against the builder because the floor supplier's manual stated that the product should not be used within 1km of salt water. Corrosivity testing at the dwelling indicated that the corrosivity classification was low. The proximity to salt water is not an indication of corrosivity, as ocean surf is required to produce the airborne salts that accelerate metallic corrosion.

The initial claim for replacement of the flooring system and supporting columns was in the order of $175,000.

Case 3

A galvanizing company accepted a quantity of steelwork from a non-account customer (a fabricator) for hot-dip galvanizing. It was processed normally. The steelwork was required for use as meat rails in a food transport vehicle. A full load of meat was transported in the vehicle and small particles of the galvanized coating flaked off the edges of the meat rails where there was point contact with the meat hooks. The meat consignment worth $40,000 was condemned as a result.

The fabricator had not used the standard meat rail flat bar sections for the rails, which have a radius on the top edge to facilitate movement of the steel hooks and prevent excessive wear on the galvanized coating on the meat rails.

The meat transport company took legal action against the galvanizer to recover damages although the galvanizer had no knowledge of the design requirements or intended application. Galvanizing value; $400. Legal costs to establish non-liability: $30,000.

Galvanized coatings can be confusing, with proportional performance. The galvanized cover at left is manufactured from pre-galvanized steel – coating thickness 18 microns. The light pole, of similar steel thickness is hot-dip galvanized. Coating thickness 54 microns, which will have 3X the durability.

UNDERSTANDING DURABILITY REQUIREMENTS

Unfortunately, corrosion and its consequences are almost totally absent from the university curriculums in the engineering and design disciplines. Unless a graduate is fortunate enough to have some exposure to practical matters associated with materials performance and protective coating systems in his or her professional career, the level of understanding of corrosion and its consequences is generally inadequate.

For much of the 20th Century, almost all state and federal governments involved in construction activities had their own experts on staff who approved and evaluated coatings and materials. In addition, full-time inspectors were employed to oversee the quality on any significant public sector projects. This is no longer the case, and much of this expertise, acquired over several generations, has been lost.

In addition, technology, particularly with paint coatings, has been changing rapidly to comply with environmental and OH&S requirements, along with innovations in coating technology.

To assess the durability of any structure, the first priority is to establish the corrosivity of the environment to which it will be exposed. There are a number of Australian Standards that can facilitate this assessment, in the form of AS.NZS 2312 - *Guide to the protection of iron and steel against atmospheric corrosion,* AS 4312 - *Corrosivity Zones in Australia* and AS 2309 - *Durability of galvanized and electro-galvanized zinc coatings for the protection of steel in structural applications - Atmospheric.*

Industrial Galvanizers also has its Corrosion Mapping System on its web site at www.ingal.com.au, that has been set up as a joint venture with CSIRO to provide on-line corrosivity data for any location in Australia.

In most cases, coating suppliers can assist with specification documentation and material selection. The industrial paint companies have comprehensive product data sheets on all of their industrial coatings and these can provide the basis for selection of appropriate materials for specific applications.

As well as coating selection, materials such as stainless steels also have a wide range of product options that require an understanding of SS characteristics in both fabrication and exposure, to ensure that their performance is up to specification.

As an example, my MTS business was retained by an electrical contractor to deal with a dispute with a state government department who had specified Grade 316 SS for electrical conduit for a floating wharf structure in a marine environment. The conduit was located under the open roof structure. It showed signs of rust staining within 3 months of installation and the client withheld a significant amount of the contract payment from the contractor, who had complied with the specification supplied.

The high chloride concentration accumulating in the unwashed area under the roof structure gave rise to the poor performance of the SS in that application, with the specifier being in error. The use of PVC conduit in that application would have provided a better durability solution at far less cost.

Fastener selection and specification is another area from which claims can arise for inadequate durability. While they are a minor cost element in most structures, fasteners are critical to the structure's performance.

There are Australian and international standards related to fastener durability and even if these are complied with, fasteners will usually be the weakest link in the durability performance of most structures. Structural bolts are a good example in that galvanized structural bolts are coated by hot-dip galvanizing and centrifuging. The centrifuge process spins off the excess zinc while still molted to keep bolt threads clear.

This also results in the hot-dip galvanized coating being thinner than that applied to the structural steel sections. In addition, galvanized nuts are not galvanized internally, but are galvanized as blanks and tapped after galvanizing as it is not possible to hot-dip galvanize internally threaded items without clogging up the threads. Galvanized nuts thus have to rely on intimate contact with the galvanized threads on the bolt for their anti-corrosion performance.

Where corrodents can penetrate into the threaded section of the nut, durability can be compromised. Sealing of the threaded section can minimise problems with durability where the exposure poses a potential risk, but again, this will only be done if documented in specifications.

NOT ONLY STEEL

The selection of most types of materials of construction requires an understanding of their durability characteristics. This includes timber, masonry, aluminium and coated steel cladding products such as BlueScope Lysaght Colorbond®.

A common failure associated with aluminium windows and doors that are used in marine locations is not with the windows and doors, but with the fittings – door handles, locks and hinges, These items are unlikely to be manufactured from marine grade aluminium unless specified accordingly.

Concrete durability is another major subject that involves many levels of input to ensure reliable results. Australian Standards deal with the technical matters pertaining to concrete durability while many of the problems arising result from installation factors such as rebar placement, water-cement ratios and curing practices, all of which can only be managed by diligent inspection and competent installation trades.

Clay products - bricks and tiles - are particularly susceptible to deterioration from chloride attack unless they are formulated for the application, and if these products are to be used in a marine environment, they need to be specified accordingly.

Apart from the obvious issues with termites, timber used for construction also needs to be the correct durability grade. Some timbers with very good structural properties, such as Oregon, have very poor durability in external applications.

Industry associations such as Cement, Concrete and Aggregates Association of Australia (www.concrete.net.au) Think Brick Australia (www.thinkbrick.com.au) and the Timber Development Association (www.tda.asn.au) are useful resources of information for the products that they represent.

SUMMARY

The financial and emotional cost to a specifying professional when litigation or serious dispute arises from the premature failure or poor performance of a coating system of material can be very high. The onus for product performance is increasingly being passed on to suppliers , with requirements for durability guarantees that are aimed at passing long-term responsibility from the developer/client to the designer/specifier /supplier.

Standards Australia has adopted a policy, where practical, of developing standards that are durability-based and not prescriptive and this is reflected in some of the more recently developed standards. Where an earlier standard would state that "...a coating must be a minimum of 100 microns in thickness applied over a steel surface that has been abrasive blasted to xxx standard...", the durability-based Standard will simply state that '...the coating shall have a maintenance - free life of 20 years...'

This approach places yet more responsibility on the specifier to understand and manage the factors that will ensure that the coating or material will deliver the required performance.

Durability of materials of construction is a complex subject as there are many interactive factors involved in the process. With the demise of the internal technical expertise in both public and private organisations involved in construction, independent assistance, and in particular, training has become increasingly important.

The Australasian Corrosion Association (ACA), based in Melbourne, has become much more actively involved in providing training and directing specifiers to consulting services where expert assistance is available in a wide variety of corrosion management disciplines. The ACA has a number of technical groups specializing in specific corrosion issues. Some of these technical groups include ;

- Building and concrete structures
- Cathodic protection
- Protective coatings
- Water and water treatment
- Welding and corrosion

The ACA also conducts professional development training, much of which is NACE Certified in Australia and the greater Asia region. For more information on the ACA Training Course timetable, contact

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Corrosion on several columns and splice plates on a small residential dwelling on the NSW north Coast led to a $175,000 claim against the builder when the building was 7 years old.

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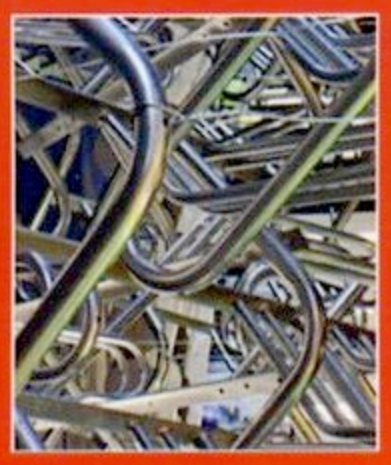
CORROSION MANAGEMENT



COVER

This abstract image is a load of hot-dip galvanized hand rails and ladders just out of the galvanizing bath and waiting to be unloaded and inspected.

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CORROSION MANAGEMENT is published for those interested in the specification, application and performance of corrosion management systems.

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This cable tray column is badly stained by 'white rust' caused by prolonged storage on site in packs during a period of wet weather. Where does the responsibility lie? - Page 24

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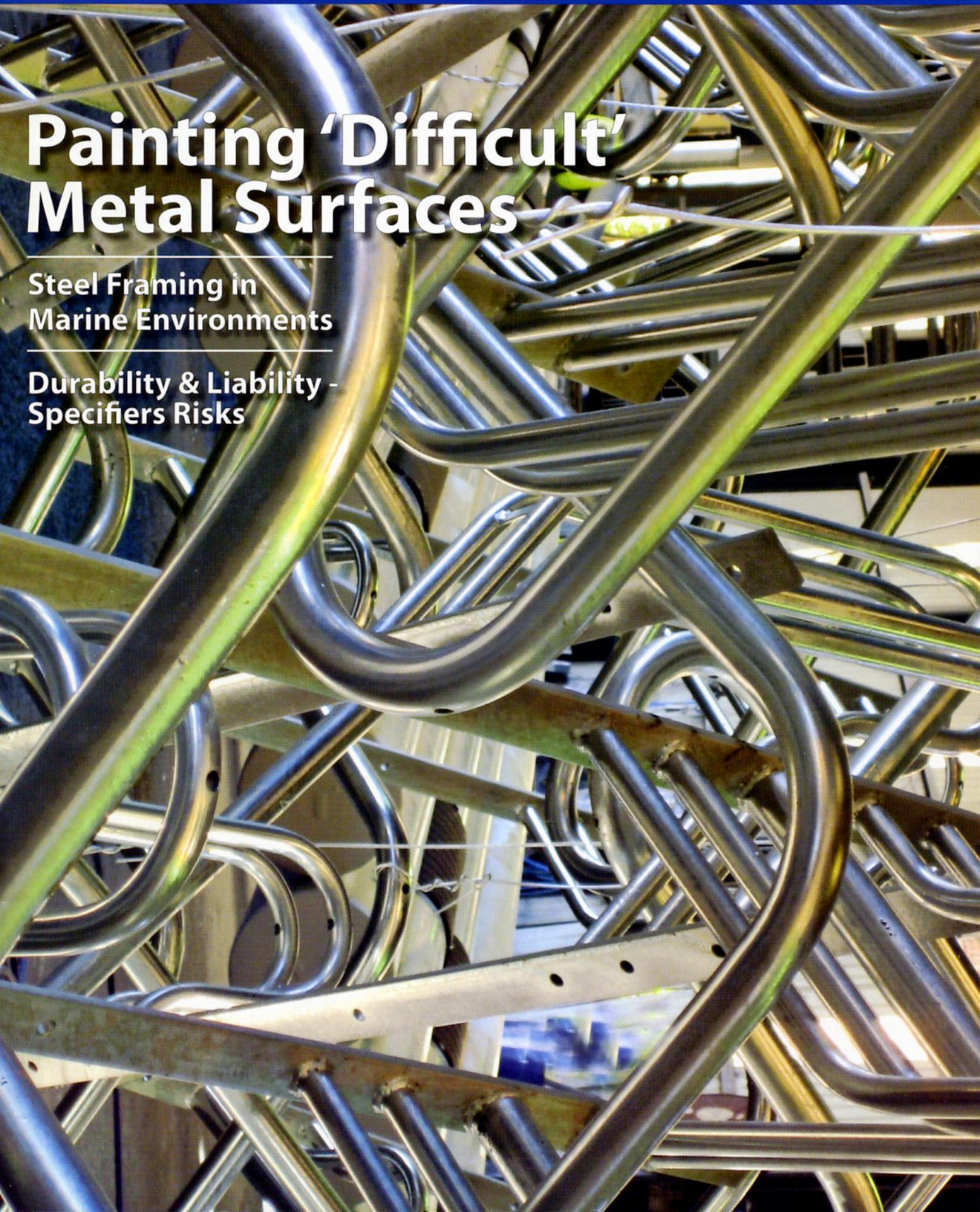

Painting 'Difficult' Metal Surfaces

Steel Framing in Marine Environments

Durability & Liability - Specifiers Risks