Polyurea Coatings for Tank Bottom Protection
All Polyurea’s Are Not Created Equal

• First thing that comes to mind is Truck Bed Liners
Polyurea Selection

- Not all polyurea’s are created equal
- Many different aspects determine a successful application of polyurea
  - Material selection
  - Surface prep
  - Equipment
  - Application
  - Applicator’s Experience
Definition - What Does Immersion Service Mean?

Immersion service refers to the use of a metallic object or metal structure in an industrial application that requires the structure to be completely engulfed or surrounded by a liquid. Metals in such applications are at a significantly higher risk of immersion corrosion.

“Corrosionpedia”

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Definition - What Does Immersion Service Mean?

- One standard for immersion testing is ASTM D6943-15. Protective coatings are used on metallic and concrete vessels to protect the substrate from corrosive attack and to protect stored materials from contamination. This method provides a means to assess the ability of a protective coating to resist degradation by chemicals and to protect the liquid cargo from contamination by either the substrate or coating, based on visual observations.
What Does Immersion Test Mean?

Immersion tests measure the progress of corrosion or coating damage obtained from the immersion length within a chemical environment, as well as other factors that can determine if a product will work in a particular chemical service.
Typical Tank Bottom Lining Materials Used

- Epoxy Phenolic’s  - Typically below 20 mils (.50 mm)
- 100% Solids Epoxies  - Typically 30-40 mils (.76 – 1.0 mm)
- 100% Solids Glass Flake-Reinforced Epoxies  - Typically 50 mils + (1.27 mm +)
- Novalac Epoxies  - Typically 20-40 mils (.50 – 1.0 mm)
- Reinforced Fiberglass Lining  - Typically 60 mills + (1.5mm +)
- Polyurea’s  - Typically 80-125 mils (2.0 – 3.175 mm)
Starting 10 Years Ago

Tank was initially lined in Feb. of 2008 with a unknown polyurea coating by another contractor. The tank floor and 3’ up the tank walls were coated. This was for API 652 “Lining of Aboveground Petroleum Storage Tank Bottoms”. After less than one year of service the lining failed prematurely. After investigating the failure, it was found that several items attributed to the premature failure of the installed polyurea lining.
Improper Surface Prep
Soluble Salts

Upon inspecting the surfaces during the removal of the failed polyurea lining, high levels of soluble salts were found. These were well above average and can easily cause increase of moisture vapor drive through the polyurea liner and cause blisters, delamination of the lining and corrosion to the underlying substrate.
The Wrong Polyurea System Selected

The polyurea lining system that was used was a typical general use polyurea lining like what would be used for a pick-up truck bed lining and not a petroleum tank lining. Seen here is actual stored product that had penetrated the polyurea lining and was between the steel substrate and the polyurea.
No Ventilation Used During Application

During the installation of any coating system in an enclosed space, requires constant ventilation for the extraction of overspray of the lining system being applied.
Poor Application Technique

It appeared that multiple thin layers of polyurea were applied over the entire lower tank wall, instead of working out small sections and spraying to full thickness. The result was overspray trapped between layers of polyurea.
Devising a Plan

• Removing the failed lining system
• Writing a specification for re-application
• Finding a coating system that would work and work good
• Getting a team together to address the problems
  • Consisted of NACE Level III QC personnel
  • Experienced Blasters and Trades
  • PDA (Polyurea Development Association) Applicators
Removal of the Failed Lining System

- Removed most by common hand tools
- Remaining was removed by 25,000psi Water Jetting
Abrasive Blasting

- Surfaces were Abrasive Blasted per SSPC-SP6 “Commercial Blast”
- Surfaces were tested again for Soluble Salts
- Surfaces were then treated to remove the Soluble Salts, or to at least get the levels down to an acceptable level
Criteria for Salt Limits

*PDA Recommendations*

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<th>≤5 µg/cm²</th>
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<td>Chlorides</td>
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*Combined total of the 3 should not exceed 20 µg/cm²*
### Criteria for Salt Limits

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Ablasive Blasting for Liner Installation

- SSPC-SP10/NACE No.2 “Near-White-Metal Blast”
- 5-6 mil surface profile was obtained
- Dehumidification equipment was used
- Environmental conditions was monitored throughout job
Quality Control During the Project
Quality Control During the Project
Application of the New Liner

- High Chemical Resistant Polyurea was chosen
- One that had been tested for immersion service in petroleum products for long term applications
Quality Control of the Applied Liner
Quality Control of the New Liner
Attention to the Details

Attention was given to hard to reach or spray locations such as nozzles, sump locations and to repair plates scattered on the floor where floor plate repair had been performed.
A Good Termination Edge

Stand-Off Masking was used to ensure that a good thick termination line was achieved. This prevented using to use masking tape around the perimeter of the tank as it never sticks.
A look at 7.5 years later

The two tanks were taken out of service for a routine inspection and the inside of the tanks were cleaned.
A Look at the Floor

The coating on the floor was in excellent shape. The coating overall was discolored due to the product that was stored in the tank. Shore Hardness and Thickness showed no signs of issues.
A Look at the Termination Edge

The termination edge still had good adhesion. There was little curl back in the leading edge where the material was thin due to the stand-off masking procedure.
Conclusion

- Product Selection
- Substrate Condition
- Substrate Preparation
- Application Equipment
- Application Team
- Application of the Product
- QC Testing of the Applied Product
- Curing of the Product Before Return to Service

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