Era
Polymers

Introducing Era Polymers Pty Ltd

Excellence in Polyurethane Chemistry

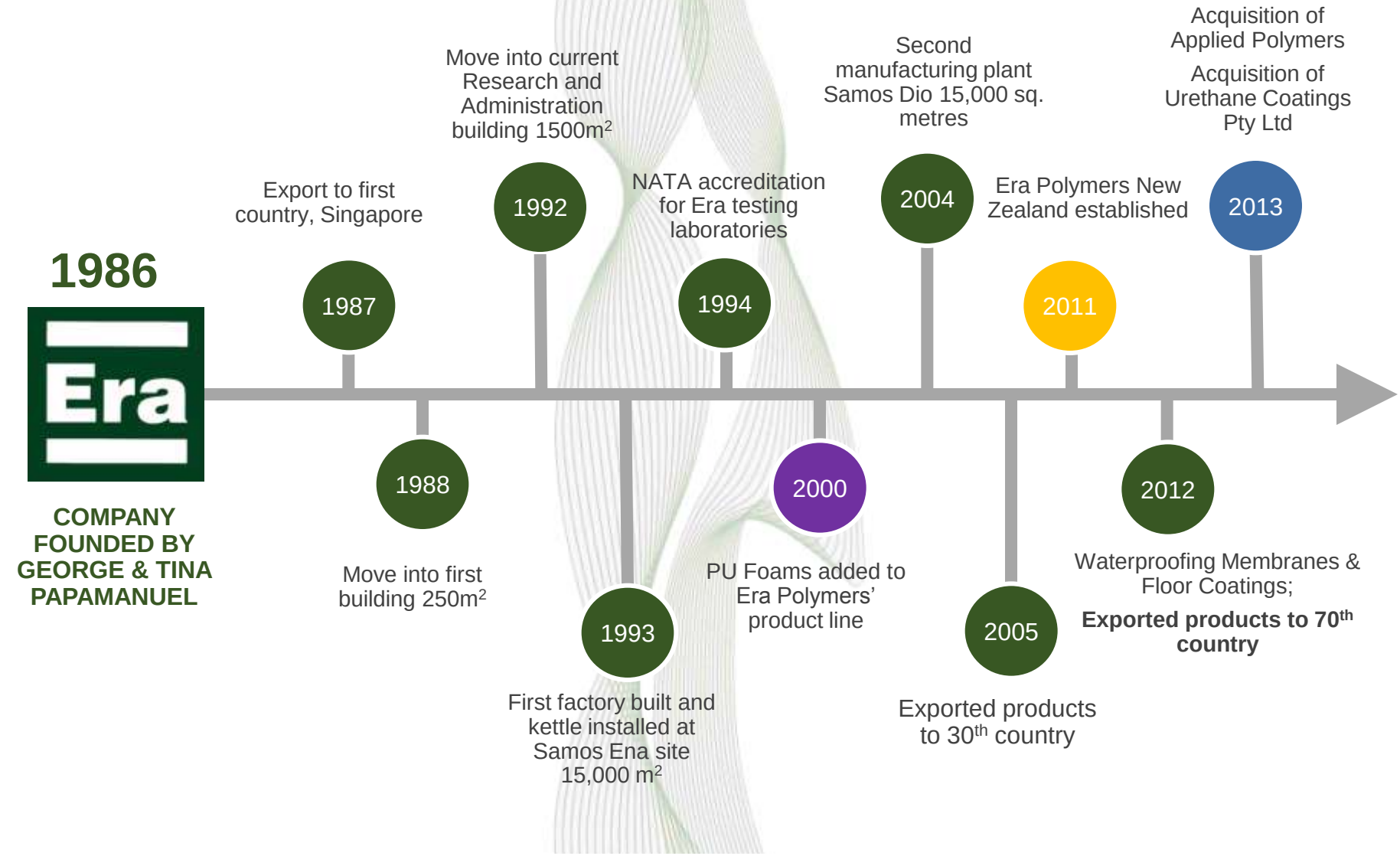
Era Polymers

A SPECIALIST POLYURETHANE COMPANY OWNED AND OPERATED BY INDUSTRIAL CHEMISTS

Australia's Largest Independent Polyurethane Systems House
• Largest supplier of high performance prepolymers in Asia
• Three state-of-the-art manufacturing facilities with >50, 000 MT production capability per year
• Worldwide Alliances
• ISO 9001 Certifed
• NATA Accredited testing laboratory
• >95 fulltime employees – within Australia and Internationally
• Strong technical service team >18 qualified chemists operating across 9 laboratories
• High level of investment into Research & development annually
• Global presence with distribution points in all regions
• Currently exporting to >70 countries

Era Polymers

TIMELINE



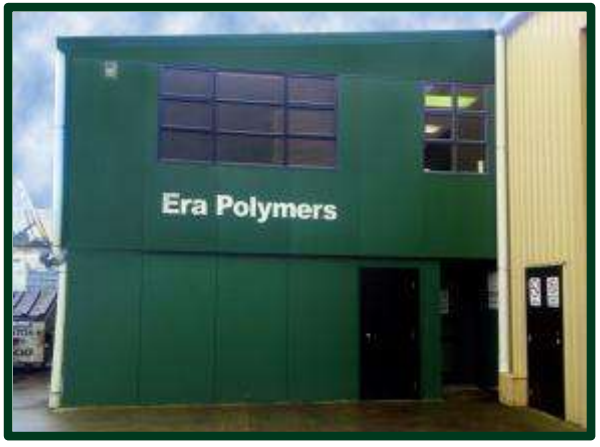
Era Polymers

HEAD OFFICE

Era Polymers

NEW ZEALAND

- Five blending tanks for polyol blending ranging from 1-20 drums
- 800m^2 Office and Warehouse area
- Recently upgraded QC and Product Development Laboratory
- Rapid response to local product demands



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APPLIED POLYMERS

ARIEL INDUSTRIES

- Acquired by Era Polymers early 2014
- Specialises in high performance insulation foam for the LNG Industry
- Melbourne based
- 1 Kettle & 9 Blending vessels

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LABORATORIES

Types of Laboratories

- Elastomer
- Foam
- Coatings
- Analytical Testing
- Cryogenic Testing
- Physical Testing

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ACCREDITATION & TEST FACILITIES

Era Polymers is an ISO9001:2008 Quality Certified Company

NATA World Recognised Testing Laboratories

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TESTS & TEST METHODS

Test	Method
AS1683.21	Determination of Abrasion Resistance using a rotating cylindrical device
AS1683.15.2	Durometer Hardness
AS1638.4	Determination of Density
AS1683.11; ISO 37	Tension testing of Vulcanised Rubber
DIN53512	Determination of Rebound Resilience of Rubber
ASTM C518	Determination of Thermal Properties of Materials – Thermal Conductivity
ASTM D6226	Open-Cell content

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PRODUCT GROUPS

ELASTOMERS	Castable, Sprayable, Trowellable MDI, TDI, Aliphatic, Ether, Ester, Caprolactone
FOAMS	Pour, Spray, Rigid, Flexible, PIR, Microcellular
FLOOR COATINGS	TDI, MDI & Aliphatic Bases
WATERPROOFING MEMBRANES	Single component, two component, spray applied
MACHINERY	Polytec EMC , Graco, Cannon & Fecken-Kirfel
TRADING / BRANDED PRODUCTS	Acmos, Fomo, Icynene, Dow Corning, Conap, Futura, Perstorp Caprolactones, Green Mountain
TOLL MANUFACTURE	Third party contract manufacturing

TWO PRODUCTION SITES IN AUSTRALIA

Samos Dio

Samos Ena

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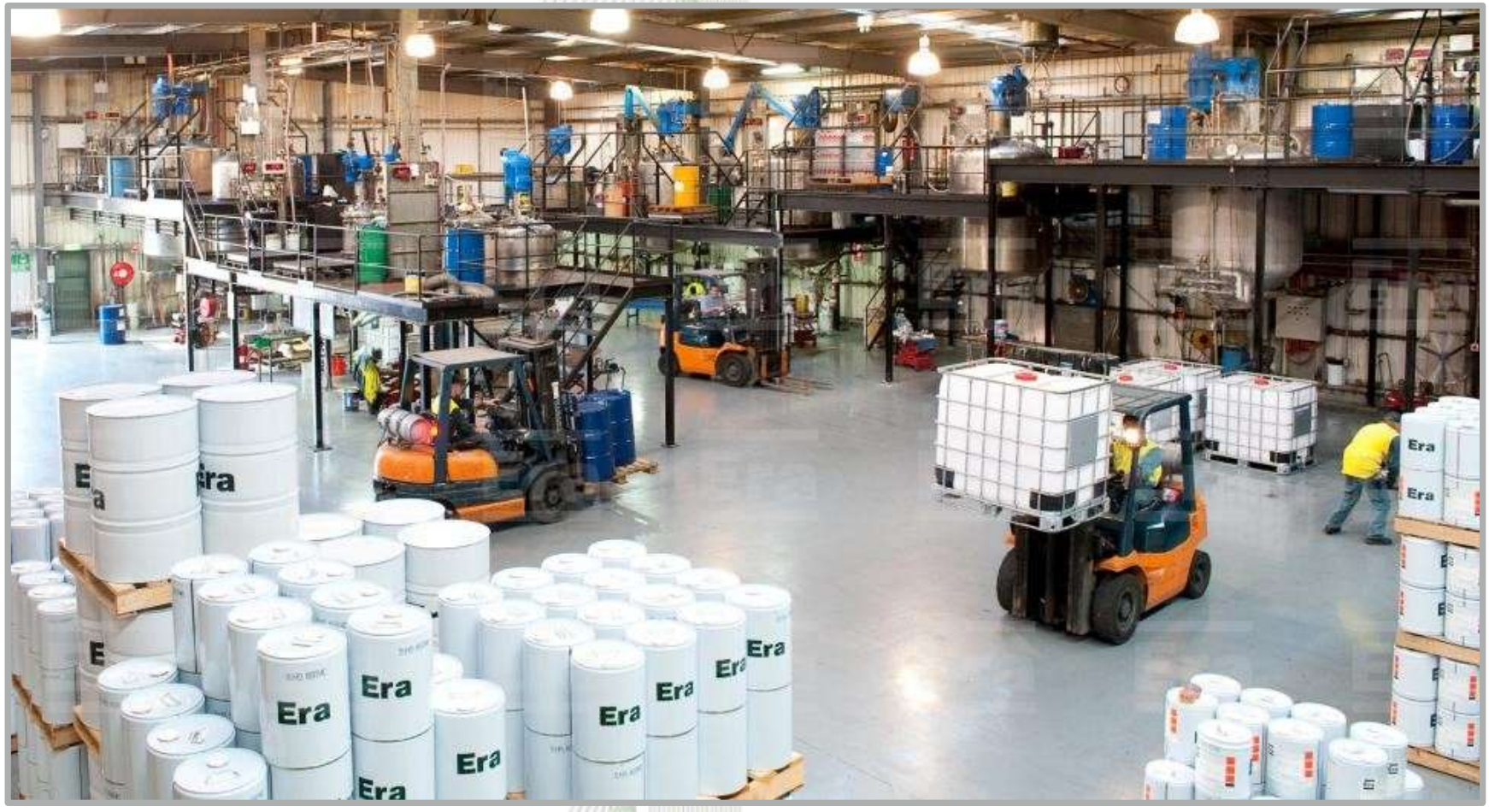
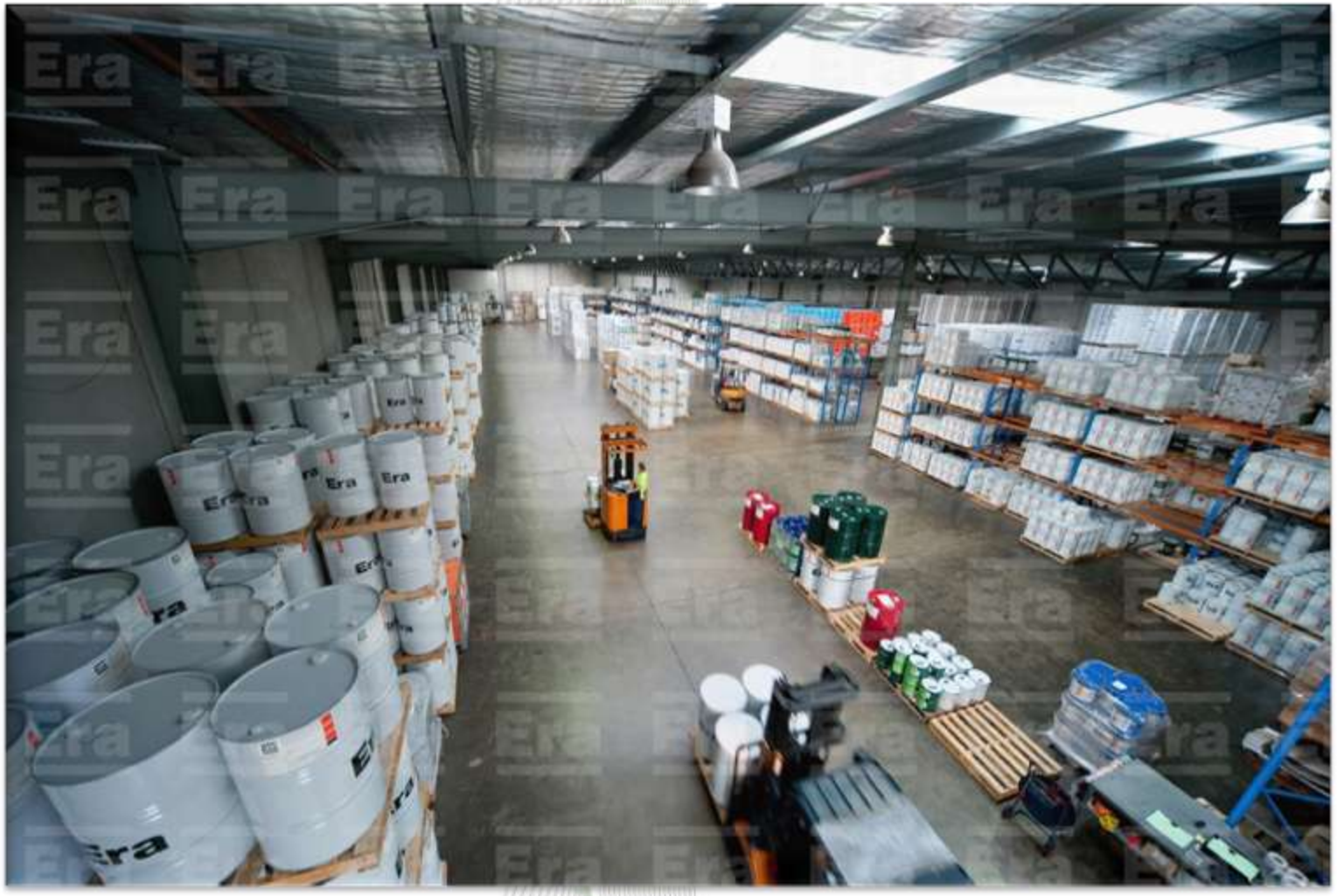
QC TESTING

MANUFACTURING



WAREHOUSING



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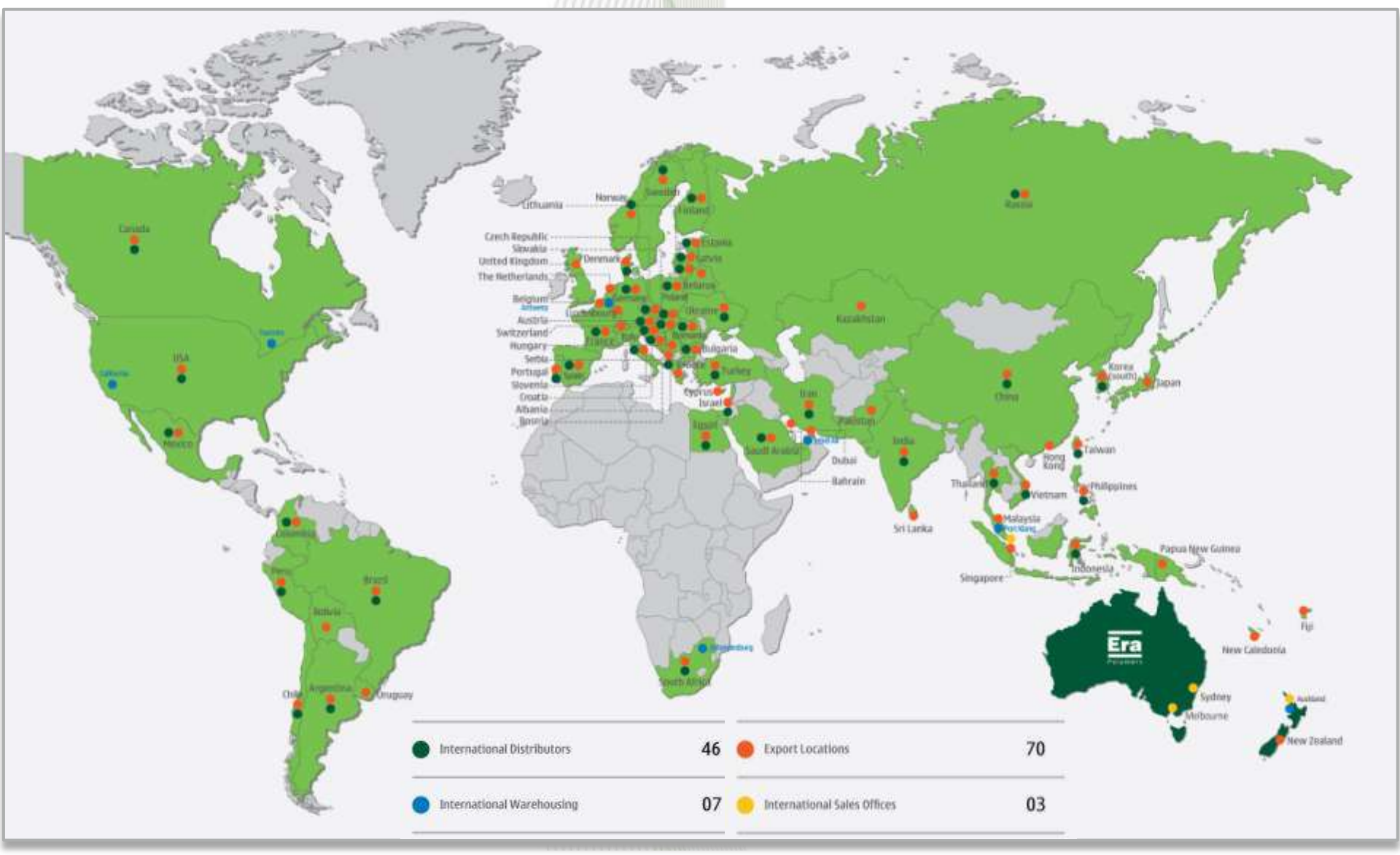
GLOBAL REACH

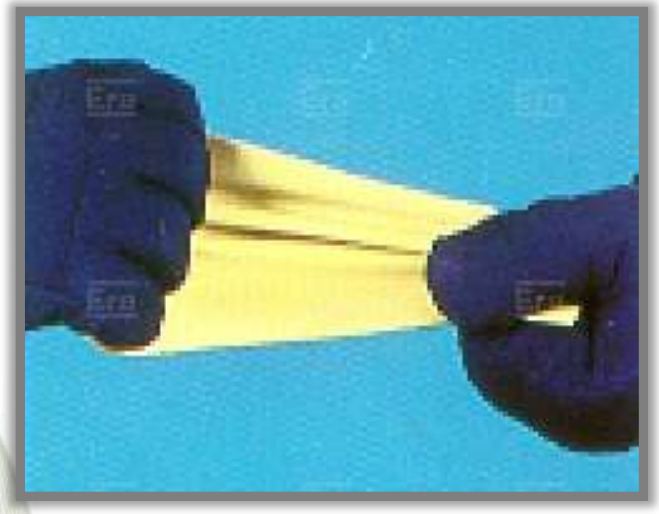


INTRODUCTION TO SPRAY ELASTOMERS

What are spray elastomers?

They are sprayable protective coatings.

These coatings are not hard and brittle
but rather flexible and rubbery.



WHY IS THE TECHNOLOGY USEFUL?

Some substrates and structures are prone to movement such as thermal expansion/contraction of metal and cracking or movement of concrete.

Flexible coatings are required to manage the substrate movement by stretching (elongating).

Hard rigid coatings will tend to crack in these situations leading to failure and loss of substrate protection.

USES OF THE TECHNOLOGY

Corrosion Protection

- Metal structures
- Pipelining

Waterproofing

- Roofs
- Concrete

Concrete Protection

- Car parks
- Industrial floors

Impact / abrasion resistance

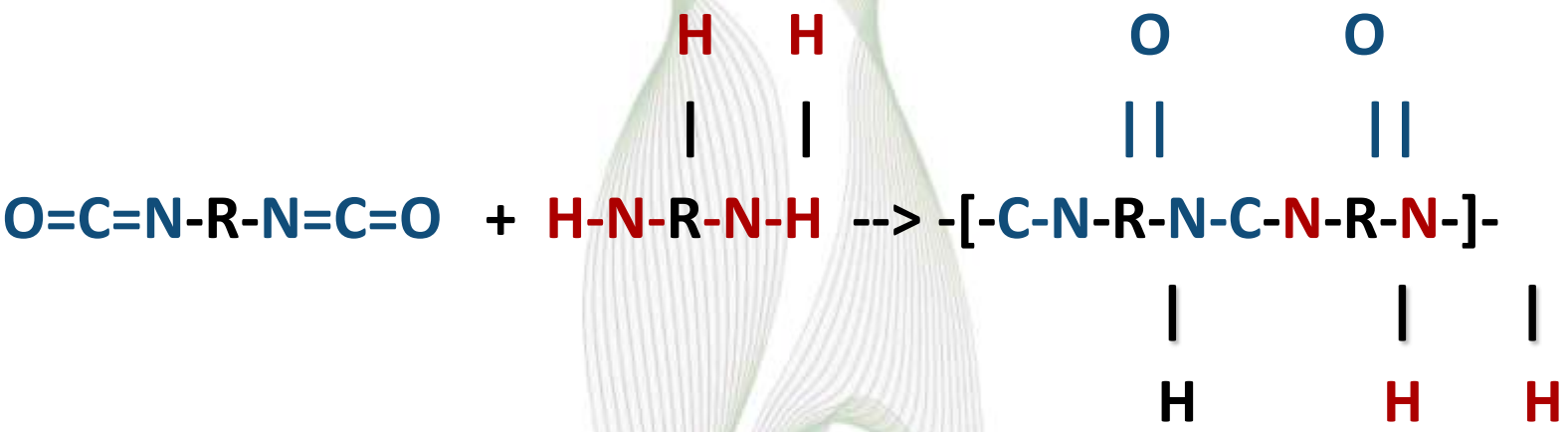
- Linings
- Mining

Architectural hard coating

- Decorative
- Hard coating foam roofs

WHAT ARE POLYUREAS?

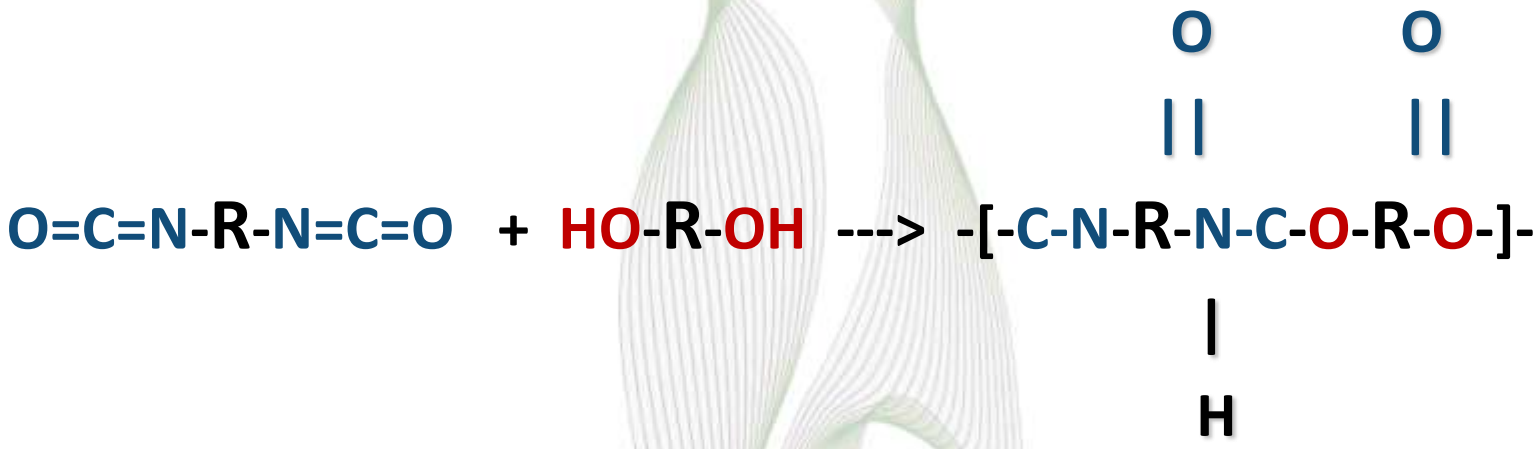
Polyureas are formed when an **Isocyanate** reacts with an amine in a rapid, exothermic reaction.



Diisocyanate ***Amine*** Polyurea

WHAT ARE POLYURETHANES?

Polyurethanes are polymeric materials produced when a liquid **isocyanate** is reacted with a liquid **polyol**.



Diisocyanate ***Polyol*** Polyurethane

POLYURETHANE OR POLYUREA?

Some of the main differences between Polyurethanes and Polyureas:

	Polyurethane	Polyurea
Tensile Strength	++	++
Elongation	++	+
Impact Resistance	++	++
Abrasion Resistance	++	+
Chemical Resistance	++	+
High Temp Resistance	+	++
Humidity/Moisture Tolerant	-/+	++
Low Temp Application	+	++
Surface Smoothness	++	-
Adhesion to primers	+	-
Ability for topcoat adhesion	+	-
Price	+	-
UV resistance/Weatherability	-	--

KEY
++ Outstanding
+ Good
- Fair
-- Poor

POLYURETHANE v POLYUREA

Physical property comparison between a high performance Polyurethane and Polyurea formulation

PHYSICAL PROPERTIES	Eraspray ST	Eraspray ESP950
Hardness (Shore A)	95	95
Tensile Strength (MPa)	17	23
Angle Tear Strength, Die C (kN/m)	75	64
Trouser Tear Strength (kN/m)	30	33
Elongation (%)	175	350
DIN Abrasion Resistance 10N (mm^3)	165	98
Cured Specific Gravity (g/cm^3)	1.03	0.96

POLYURETHANE v EPOXY

Epoxy coatings are one of the main alternatives used in opposition to polyurethane coatings.

Some advantages of Polyurethanes over Epoxies are:

- Polyurethanes can be designed to be elastomeric or rigid, while epoxies are normally rigid or even brittle;
- Polyurethanes could be cured relatively quickly at low temperatures whilst epoxies tend to cure slower or sometimes not cure at all at very low temperatures.
- Polyurethanes generally have excellent abrasion resistance compared to other industrial coatings systems.
- Aliphatic Polyurethanes are well known for their excellent UV resistance and colour stability, while epoxies and aromatic polyurethanes may not be used for certain exterior applications (application dependant).

POLYURETHANE v RUBBER

Advantages of Rubber Linings Compared with Polymer Linings

Prefabricated sheets of constant thickness

High permeation resistance

Good abrasion resistance

High elasticity

Disadvantages of Rubber Linings Compared With Polymer Linings

Limited resistance to organic chemicals (organic solvents!)

Low resistance to mechanical forces (cutting, impact, etc)

Lower resistance to high temperatures

Sheets are glued into place leaving the joints as a possible mode of failure.

Limited to STD rubber sheet thicknesses

More labour Intensive

Cost

POLYURETHANE v RUBBER (Cont'd)

Polyurethane v Linatex Rubber

- Blasting costs, Priming costs and Material costs approximately the same for both.
- Labour and speed of application provides cost savings for the PU
- Seamless, no joins etc.
- Final Price approx 15 - 20% Cheaper

HANDLING ADVANTAGES

Key FEATURES of sprayable elastomers include:

- 100% solids i.e. solvent free.
- Set/cure at variable temperatures - winter and summer.
- They are NON flammable.
- Can be applied in a single or multi-pass coat to different dry film thicknesses.
- Set in minutes.
- Can be put into service within hours.
- They can be easily repaired if damaged.
- They require NO post curing.

PERFORMANCE ADVANTAGES

In addition to the handling advantages there are also a number of important performance advantages which include:

- Superior adhesion with a suitable primer.
- Resistance to chemical attack.
- Resistance to gouging and abrasion.
- Flexibility and resilience.
- Impermeable.
- Fast setting
- Formation of a totally seamless polymer coating that is adhered to the substrate.

ELASTOMERIC SPRAY SYSTEMS

SPRAY CONSIDERATIONS

- Substrates
- Environmental Conditions
- Primers
- Spray Material to use
- Machinery
- Desired physical properties.

SUBSTRATES

Common Substrates

- Metal
- Concrete
- Geotextile

Substrates to avoid

- Silicone
- Polyethylene
- Polypropylene
- Phenolic Foam
- EPDM
- Teflon

ENVIRONMENTAL CONDITIONS

Temperature Conditions

- At low temperatures the reaction can be slowed which also causes slower cure..
  - Ambient/Atmospheric/Temperatures
  - Substrate Temperature
- Dewpoint consideration is important (temperature at which vapour will begin to condensate)

Wind

- Wind is a major factor when spraying outdoors
- High wind can affect spray patterns and disrupt the even distribution of material
- It is important to determine winds velocity and direction before commencing.

Dew Point

- Temperature and Humidity are very important during application of a spray elastomer
- A spray elastomer should ONLY be applied if the substrate temperature is 4°C above the Dew Point and Rising.
- If not then moisture will condense on the substrate and cause adhesion issues.

Examples

Temperature °C	Humidity %	Dew Point °C	Difference	OK to spray
25	90	23.2	1.8°C	NO
25	50	13.9	11.1°C	YES
20	90	18.3	1.7°C	NO
20	40	6.0	14°C	YES
15	90	13.4	1.6°C	NO
15	40	1.5	13.5°C	YES

What to watch for:

Substrate Heat Sink

- Typically thick metallic substrates like steel tend to retain cold temperatures
- Reaction temperatures of fast set coatings can be drained and retard the curing.
- Subsequent layers are insulated and cure ok, but delamination can occur at the first layer.

Pinholing and Outgassing

- When substrate contains moisture and CO_2 is formed by reacting with water.
- When the substrate is porous, entrapped air expands when heated and escapes through the coating.
- When substrate is contaminated usually by oil or silicone the material flow or dispersion can also be affected.

PRIMERS

Adhesion is a very important factor when bonding spray coatings.

Primers are designed to adhere to certain substrates that are correctly prepared to accept the top coat.

Adhesion windows are critical and should be followed closely for each different primer.

For maximum adhesion generally all primers should be spray coated with the elastomer within 12 hours.

The adhesion window of the primer will generally decrease as the temperature increases.

- **NOTE** : Primer dry film thickness (DFT) must be followed as per the recommended technical specifications indicated on the TDS in order to achieve maximum adhesion to the substrate.

WHICH TYPE TO USE?

TYPE	Application
Medium Performance	This type is suitable for most general applications. Waterproofing, corrosion and general wear being the main industrial use.
High Performance	This type is used where abrasion resistance is important. Applications include Industrial coatings in the Mining Industry, Coal Wagons, Truck Beds, Screen decks, Chute / Launder and Hopper linings etc.
Polyurea	Polyureas are used in similar applications to high performance Polyurethanes. They have faster gel times so tend to have better adhesion to substrates when moisture is present.
Aliphatic	UV Stable
Potable Water	Potable water approved* (AS/NZS 4020:2005)

EXAMPLE

To spray Polyurethane Elastomers you need the following:

- Plural Component Proportioner
- Heated Hoses
- Heated Whip Hoses
- Fusion Spray Gun
- Supply Pumps
- Agitators

PHYSICAL PROPERTIES

Some physical properties to consider when selecting the spray coating	
Abrasion Resistance	Thermal Coefficient of Expansion
Bond Strength	Water Absorption
Hardness	Tear Strength (Angle)
Elongation	Tear Strength (Trouser)
Flexural Modulus	Flexural Strength
Tensile Modulus	Tensile Strength

TROUBLESHOOTING

Common Causes

Adhesion Problems

- Improper surface preparation
- Insufficient surface preparation
- Incorrect primer selection
- Coating outside recoat window

Chemical Contamination Problems (Isocyanate)

- Moisture presence from incorrect sealing of the drums after opening
- Insufficient Nitrogen purge after opening of part drums.

Unmixed problems arising from insufficient stirring (Polyol)

- Material will lose its key physical properties
- Colour variations
- Cure problems
- Tacky surface

Storage Problems

- Low temperatures can cause material to freeze.
- Exposure of drums to weather (Rain) can cause moisture absorption.

Wet Substrate Problems

- Polyurethanes are moisture sensitive and spraying onto wet or moist substrates can cause foaming, blistering or poor surface appearance.
- Loss of adhesion.

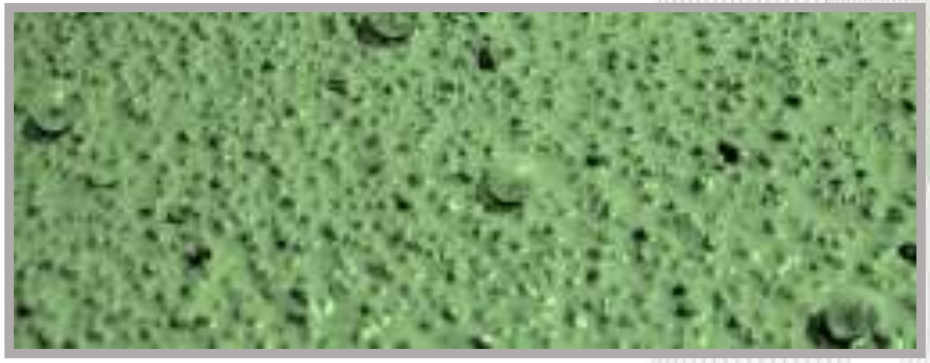
Foaming Due To High Humidity

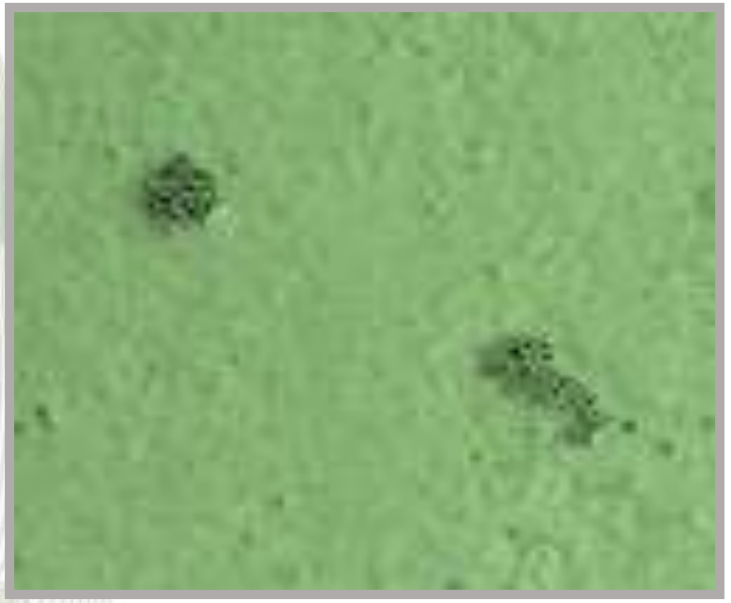
- In high temperatures there is more humidity in the air.

- Solutions
  - Polyureas tend to be more tolerant to humidity.
  - Increase spray tip size (larger spray particles).
  - Spray under appropriate humidity conditions.

Foaming Due to moisture ingress into Material

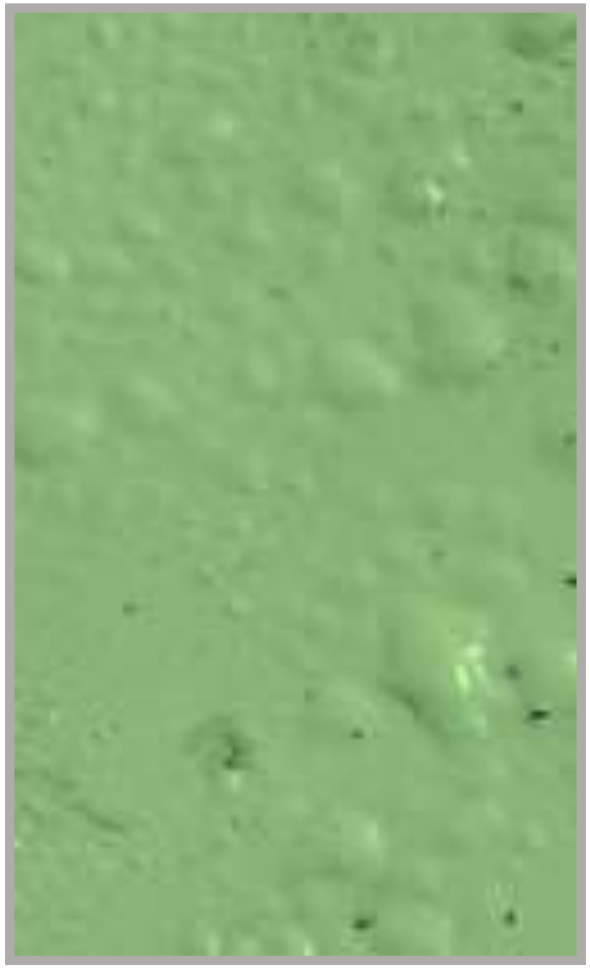
- The Polyol Component is hydrophilic, if drums are left open atmospheric moisture can be absorbed.
- When Isocyanate reacts with moisture carbon dioxide is produced and crystallization becomes evident in the material.





Pinholing

- Commonly caused by:
  1. Small microscopic voids or pinholes in the substrate.
  2. Moisture embedded in the substrate.



Blistering (Trapped solvent)

- Blisters occur when solvent becomes trapped by the cured surface coating of polyurethane.

Blistering (Thick coating)

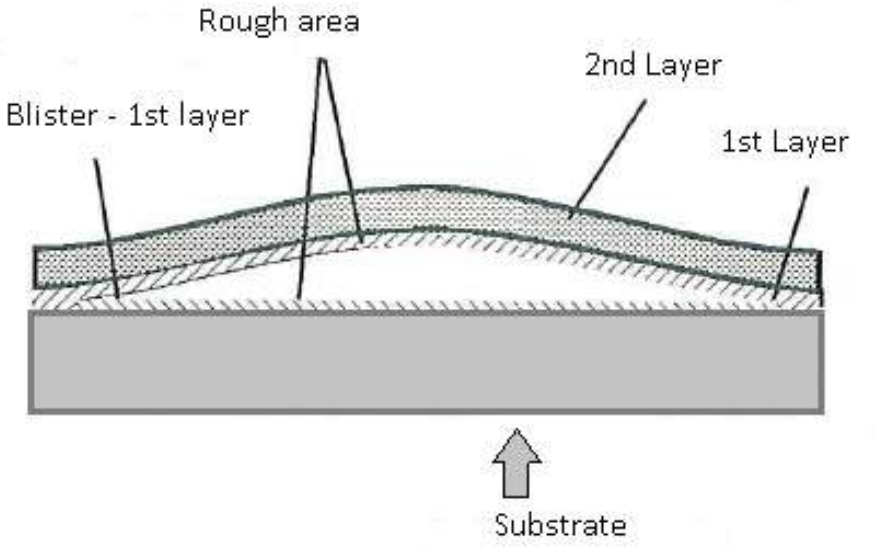
- Coating blisters are caused by the coating layer being applied at too high a thickness. They can appear as round or oblong blisters and depending on the state of cure, can feel spongy or uncured beneath the surface when examined.

Peeling / Delamination

- Delamination may be caused by improper surface preparation, moisture, contamination from dirt, dust, concrete residue etc. , incompatible materials and closing of the primer adhesion window. The photo on left is typical for delamination of the coating after the adhesion window, whilst photo on the right is typical of delamination from improper surface preparation causing no adhesion in the specific areas.

Thermoblistering / Delamination

- Defined as a blister within two layers
- Two possibilities exist;
  1. Cold substrate or the substrate acting as a “heat sink”; causing a slow cure on the 1st layer.
  2. If 1st Layer is applied too thick this will cause a high exotherm and not allow the coating to wet out or react with the previous layer thus causing delamination.



SURFACE PREPARATION

Surface preparation is **CRITICAL** in obtaining good adhesion to any substrate.

POOR surface preparation = POOR coating performance.

The surface preparation will generally include
Abrasive blasting to achieve a suitable mechanical bond
Solvent washing / Degreasing to remove any contamination
Application of a suitable primer to achieve good chemical bond
Application of coating

SURFACE PREPARATION

Steel	Concrete
Grind to remove all sharp edges, corners, weld beads, weld slag and splatter.	Grind flat to remove any possible surface defects
Thoroughly clean/solvent degrease surface to remove all traces of oil and grease.	Clean surface to remove all traces of oil and grease using high pressure steam or water. Rinse areas with clean water afterwards.
Compressed air must be dry, free of oil, water and other possible contaminants. Abrasive grit blast to recommended specification E.g.: SSPC-5P-5 “White Metal Finish” SSPC-SP10 “Near White”	Repair substrate of any possible voids and imperfections with suitable grouting material E.g. PU trowellable ,epoxy or resin system.
Vacuum clean blasted surface with heavy duty industrial cleaner	Vacuum to remove dust and possible surface debris.
Apply appropriate primer	Apply appropriate primer

TYPES OF PRIMERS

CONCRETE SUBSTRATE – Use Erabond Concrete

Fast Dry (2 hours), solvent based single component polyurethane

Dries to hard film to resist outgassing from concrete

Can be mixed with sand to make a filler for filling small holes and defects in the concrete slab

STEEL SUBSTRATE – Use Erabond 6100 STD and optional 6100 FC (Fast Cure)

2 Component high solids primer

Recommended for Steel, Iron and Galvanized metal substrates

STEEL SUBSTRATE – Erabond CM

2 Component
Recommended for Mild steel , Aluminium and Galvanized steel substrates
Contains anti corrosive additives

SPRAYABLE RANGE

SPRAYABLE PRODUCTS			
TYPE		**PRODUCT**	**APPLICATION**
Medium Performance MDI	**ERASPRAY ESM RANGE**	Eraspray ESM700	Waterproofing, corrosion and general wear
		Eraspray ESM800	
		Eraspray ESM900	
		Eraspray ESM955	
		Eraspray ES900PW	Potable water grade
TYPES		**PRODUCT**	**APPLICATION**
High Performance MDI	**ERASPRAY ESP RANGE**	Eraspray ESP880	Abrasion resistance, e.g Industrial coatings in the Mining Industry
		Eraspray ESP950	
TYPES		**PRODUCT**	**APPLICATION**
High Performance TDI	**ERASPRAY SPECIALTY RANGE**	Eraspray ES81A-HB	Abrasion resistance ,e.g. Industrial coatings in the Mining Industry
		Eraspray ES321	Abrasion resistance
Polyurea		Eraspray ST	Similar applications to high performance Polyurethanes with certain chemical and higher temperature resistance properties.
		Eraspray ESU610D	High Hardness Polyurea
Aliphatic Coating		Eraspray AL950	Outdoor applications - UV resistant
Polyaspartic Coating		XPE 11-1441	UV resistant overcoat for Polyurea and Polyurethane coatings, industrial and commercial flooring and deck coatings

CASE STUDIES – Pontoon North QLD

ESM900 Grey PU spray + Erabond 6100 FC Red Primer

Pontoon surface preparation consisting of 2½ class blast of new steel and repaired steel sections and whip blast of existing paint sections.
Substrate washed with solvent after blasting.

Blasted substrate coated with **Erabond 6100FC Red** primer.
This is a fast cure priming system with an added anti-corrosive package.

Spray application to 3mm coating thickness of **Eraspray ESM900 grey** via high pressure impingement mixing equipment.

Finished pontoon which will be used to supply fresh water to a coal preparation plant.

CASE STUDIES: Waterproofing & Containment

Ecofoam RS2048 PU foam, Eraspray ESM900 spray, Polyaspartic XPE11-1441 White spray

Watercare Waste Water Digester 8 – Mangere, Auckland, New Zealand

Watercare Waste Water needed to increase the capacity for anaerobic digestion at their Mangere Plant, part of this project included the construction of a new sludge digester, Digester 8. This new floating tank required waterproofing and containment. The waste treatment(sewage) is maintained at 40^0C methane gas emitted is utilised within the treatment plant.

CASE STUDIES: Waterproofing & Containment

Ecofoam RS2048, Eraspray ESM900, Polyaspartic XPE11-1441 White
Watercare waste water digester 8 – Mangere, Auckland, New Zealand

- The steel structure was coated with Epoxy
- A 50 mm layer of Ecofoam RS2048 to provide insulation. Ecofoam RS2048 is a two-component polyurethane water/HFC blown foam sprayed-in-place polyurethane foam insulation, with fire retardant.
- A coating of Eraspray ESM 900 to protect the foam. Eraspray ESM900 a non-solvented polyurethane spray elastomer designed for industrial applications where good physical properties are specified an ideal choice for Digester 8.
- A coating of white polyaspartic XPE11-1441W to stabilise the UV COLOUR. XPE 11-1441 is a VOC-free, aliphatic coating designed as an abrasion resistant topcoat for polyurea and polyurethane systems.
- Finally a light coating ofXPE11-1441 with anti-skid on top to add slip resistance for maintenance engineers access.




CASE STUDIES: Sewerage Industry - Digester Tank Insulation

Eraspray ESM900
SA United Water Bolivar Digester Tanks

Era Polymers assisted in the refurbishment of this 40 year old digester tank. The refurbishment included repairs to the internal metal work, pumps etc. as well as replacing the insulated roof. The digesters are maintained at 35^0C for efficient anaerobic processing of sewage; to maintain this constant temperature sufficient insulation is required, **Era Polymers** products were specified.

CASE STUDIES: Sewerage Industry - Digester Tank Insulation

Eraspray ESM900
SA United Water Bolivar Digester Tanks

PROCESS:

- Steel Surface Shot Blast to remove any contaminants
- Metal primer was applied followed by a 50mm layer of **Stepanfoam RS3011** 48kg/m3 sprayfoam to provide insulation
- Finally a 5mm coating of **Eraspray ESM900** elastomeric spray coating was applied to protect the insulation layer.

The refurbished digester is now set **for extended life and operation!**

CASE STUDIES: Car Park Decking

ESM955 PU Spray + Erabond Concrete primer

Sealtec – New Zealand

CASE STUDIES: Car Park Decking

ESM955 PU Spray + Erabond Concrete primer

Sealtec – New Zealand

CASE STUDIES - Abrasion Resistance and Waterproofing

ERASPRAY ESM900
Foam Pontoon Lining – Anzac Bridge Marina

Eraspray ESM900 is a medium performance MDI Polyurethane/Polyurea with a hardness of 90 Shore A, a general purpose product with good impact abrasion properties and was an ideal choice for this project where abrasion resistance and waterproofing needed to be addressed.

• Size of Project	250 m^2
• Film Thickness	2 mm
• Spray Equipment	H20/35 PRO
• Surface Preparation:	None
• Project complete	1 Day
• Number of Workers:	2
• Materials Used	Eraspray ESM900

CASE STUDIES – Secondary Containment

Eraspray ESP950 + Erabond CM primer
Quenos Polyoleifin Tank Farm

Era Polymers were closely involved in the specifying and then application of the **ESP950 Polyurethane** around chemical tanks at Quenos chemical plant in Sydney. After months of accelerated immersion testing the **ESP950** was specified and then applied by spray application. The surrounds of the tanks were previously coated with Rigid Epoxy Paints that could not withstand any substrate movement and had subsequently cracked and were ineffectual. The **ESP950** has proved successful for the specific job.

• Size of Project	2600 m^2
• Film Thickness	1-2 mm
• Spray Equipment	H20/35 PRO GX7 Gun
• Surface Preparation:	Wash / clean of exterior tank surface.
• Project complete	5 Days
• Number of Workers:	4
• Materials Used	Erabond CM Primer Eraspray ESP 950

CASE STUDIES – Wear Protection & Waterproofing

Eraspray ESM900 PU Spray + Erabond Concrete Primer
The Lakes Mall Shopping Centre

ESM900 is a medium performance MDI Polyurethane with a hardness of 90 Shore A.

• Size of Project	2500 m^2
• Coating Thickness	2 mm
• Spray Equipment	Gracco EXP-2 Fusion Gun Air Purge
• Surface Preparation:	Grinding of horizontal floor + high pressure water clean
• Project complete	11 Days
• Number of Workers:	3
• Materials Used	Erabond Concrete Primer Eraspray ESM900

CASE STUDIES – Protective Lining

ERASPRAY ST Polyurea + Erabond Concrete Primer
EcoCivil and Hunter Water Corporation

The **Eraspray ST** was the ideal protective lining material in order to offer good chemical resistance, applied by Polymer Technology International for the internal spraying of a sewerage manhole concrete collar.

PROCESS:
Priming – Erabond Concrete
Spraying - Eraspray ST
Graco Spray Equipment was used
Internal spraying of the concrete collar ready for Installation

Concrete collar was water blasted to remove contaminants and surface defects were subsequently repaired with a fast set epoxy grout.
Erabond Concrete (yellow) primer was applied with a roller and allowed to dry
Eraspray ST was sprayed onto the surface at approximately 4mm thickness
The sprayed collar was put into its final position later that same day.

CASE STUDIES – Waterproofing

Era Polymers R&D Facility Roof Top– ESM900 PU + Erabond 6100 Primer







CASE STUDIES –Roofing / Waterproofing

Eraspray ESM900

Valencia Apartments - Homebush Bay Sydney.

CASE STUDIES

ESP950 PU + Erabond Concrete Primer

Hornsby Honda – Car Park

General Safety Information

SDS (Safety Data Sheet)

- Always read before using a new material
- Pay particular attention to sections

2	Hazard Identification
4	First Aid Measures
5	Fire Fighting
8	Exposure Protection / Personal Protection

General Safety Information

Part A – Isocyanates

- Inhalation can produce severe irritation of the respiratory system.
- PPE must be used to avoid exposure.

Incase of Exposure to Isocyanates

- Remove person from immediate environment

Part B – Polyols

- As applicable PPE must be used.

THANK YOU

QUESTIONS?