Polyethylene Pipe Standards are Changing ~ the Critical Implications for the Water Industry

Presented by PIPA NZ

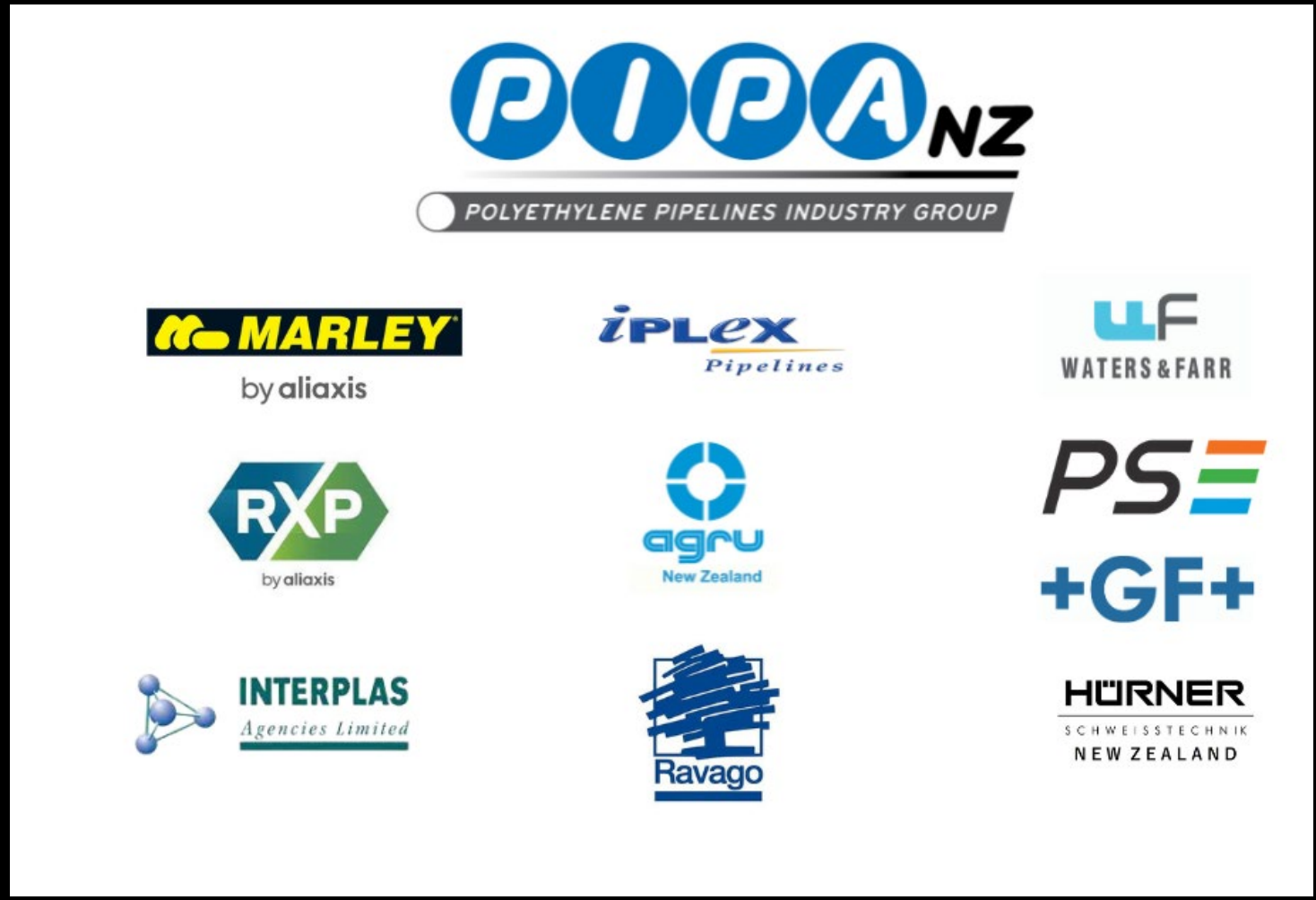
Who we are

Background

Established 2015

Representing all the stakeholders in polyolefin pipe material supply, manufacture, fusion, and fusion equipment supply

WE advocate in standards development and training & education programmes

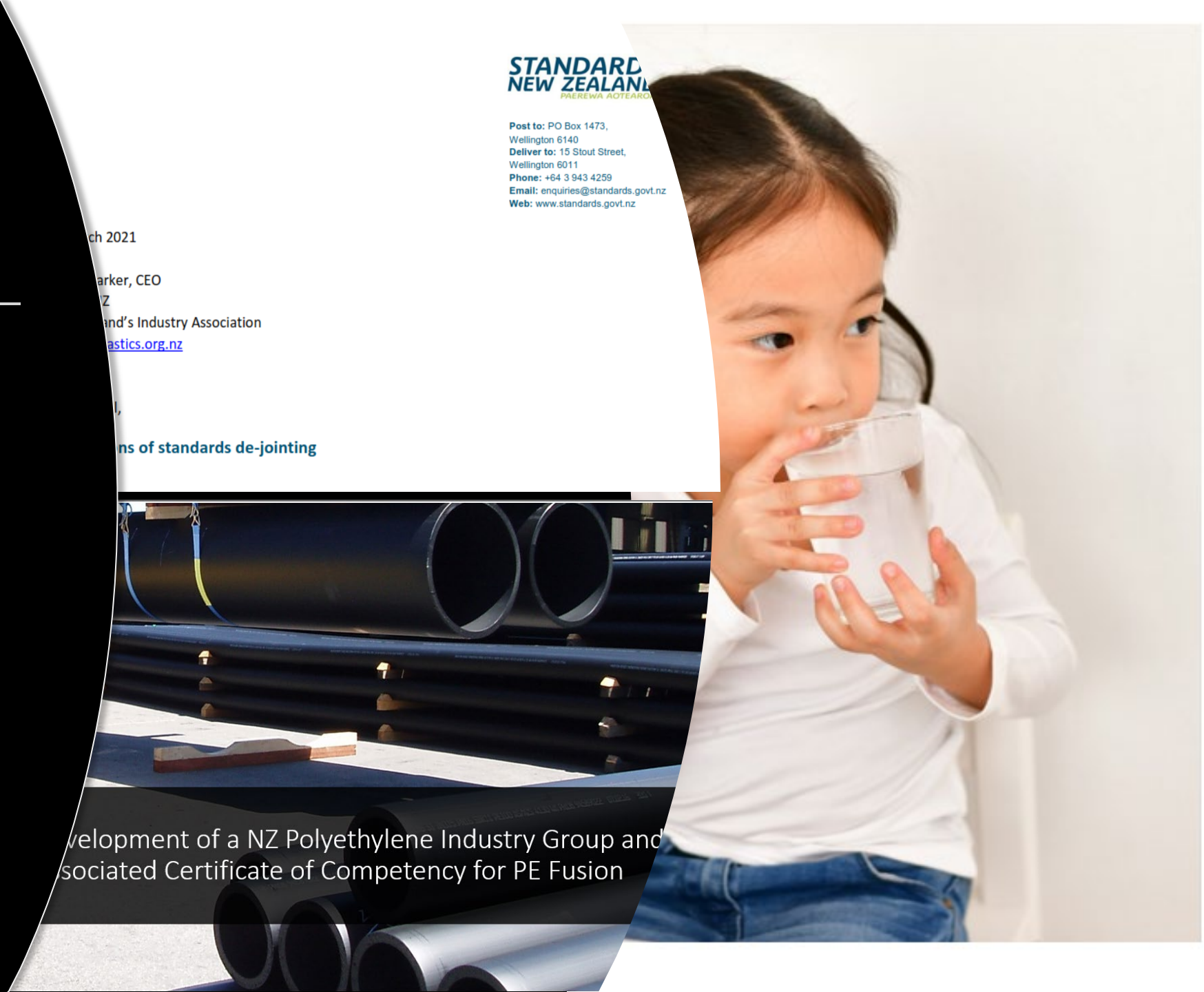


Mission Statement:

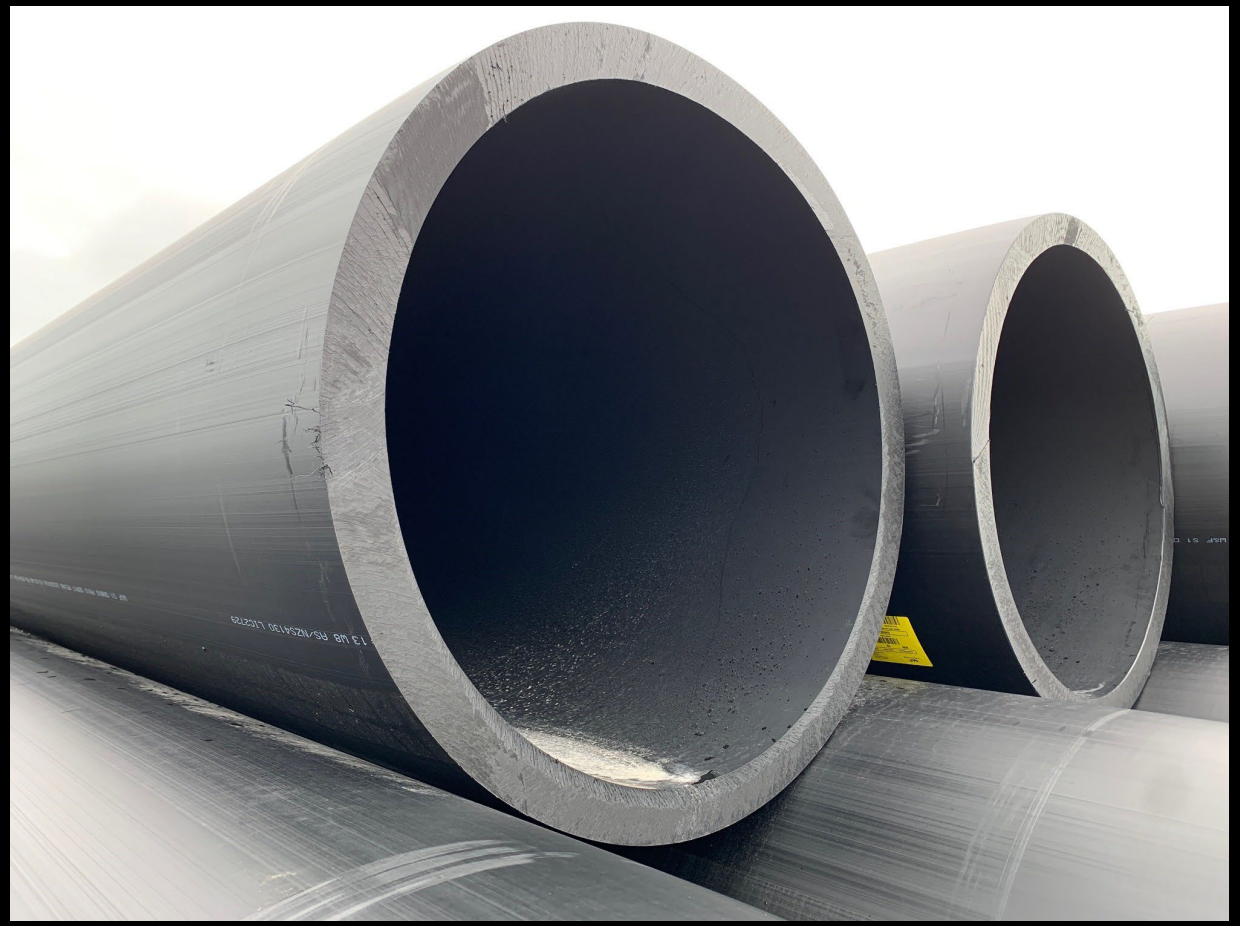
“leading the correct specification and installation of polyethylene pipe systems”

Activities so far

- 2017 Conference: Paper in Trenchless Stream and to Water Service Managers Group
- 2020 Conference: New Generation PE100 paper delivered to Trenchless Stream
- 2021 Lobbying against Standards Dejointing



Polyethylene is…

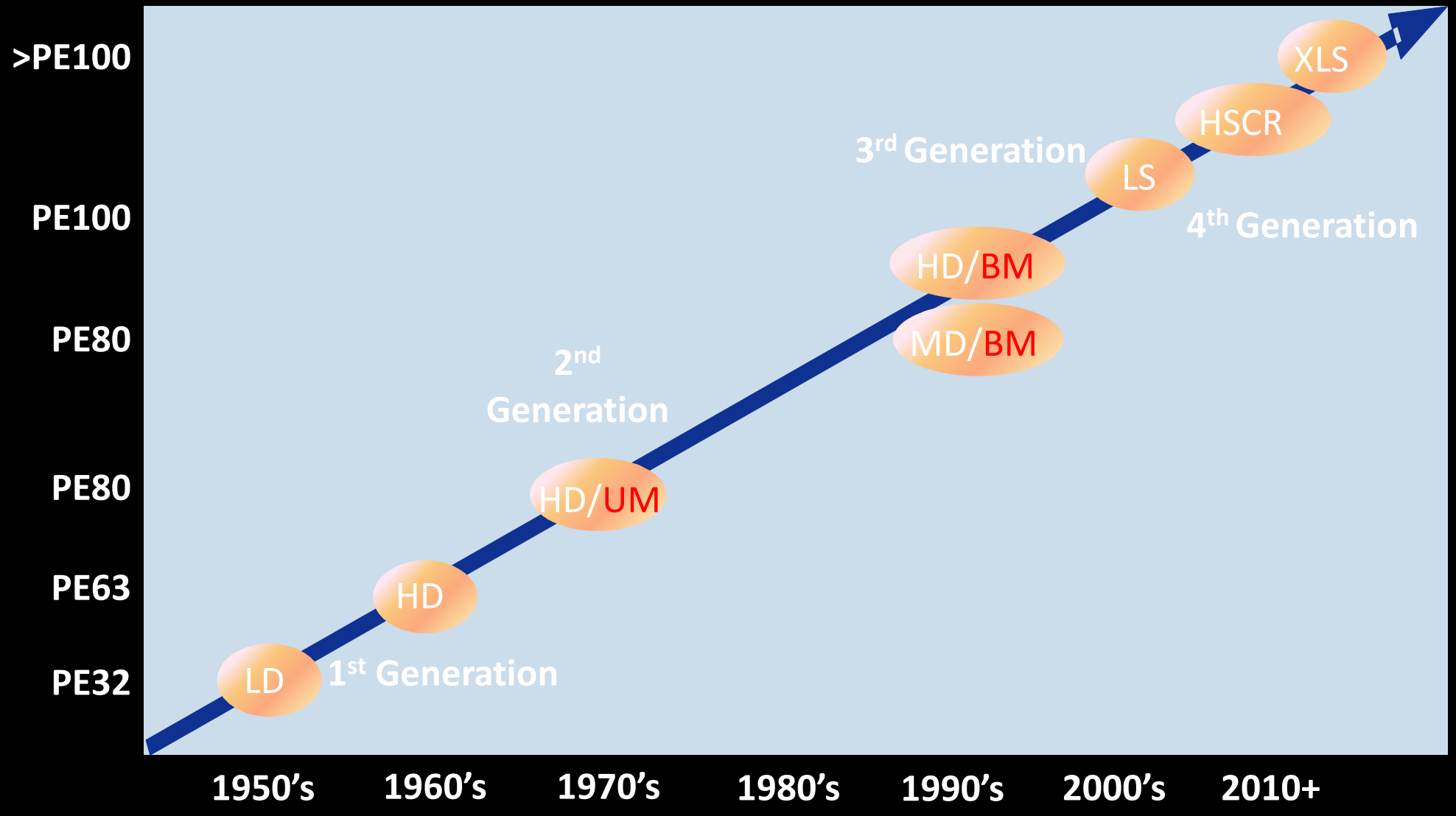


Central to Water NZ's Pipeline Resilience Strategy

The optimum pipeline material for Trenchless Operations

Corrosion Free, Flexible, Durable, Seismic Resistant, Maintenance Free

We have been using it for 70 years



XLS
Extra Low Sag

HSCR
High Stress Crack Resistant

LS
Low Sag

BM
Bimodal

MD
Med. Density

UM
Unimodal

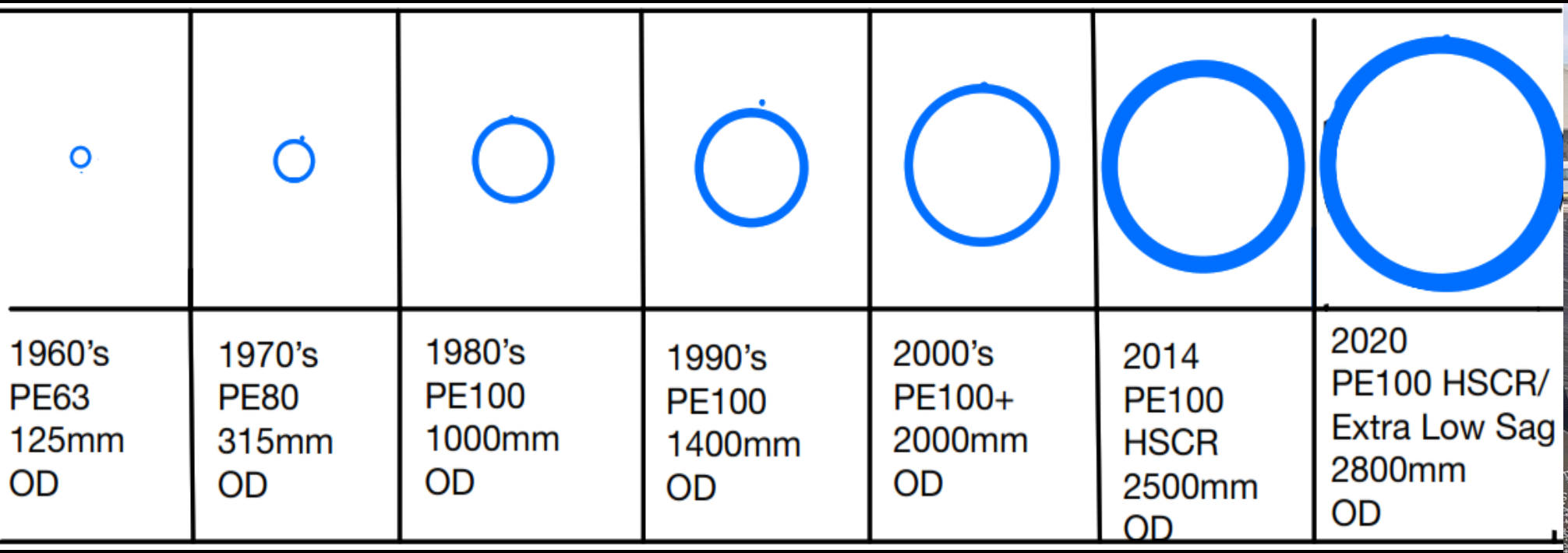
HD
High Density

LD
Low Density

Product innovation over the journey

Properties	1960's	1970's	1980's	1990's	2000's
MRS Classification	PE63	PE80		PE100	PE100 (HSCR)
Density	High Density (1st Gen)	High Density (2nd Gen)	Medium Density	High Density (3rd Gen)	High Density (4th Gen)
Slow crack growth by Notched Pipe (ISO 13479)	800 kPa ~50 hrs	800 kPa >165 hrs	800 kPa >500 hrs	920 kPa >500 hrs	920 kPa >5000 hrs

Growth in the size of extruded PE pipes using vacuum calibration



1960's PE63 125mm OD	1970's PE80 315mm OD	1980's PE100 1000mm OD	1990's PE100 1400mm OD	2000's PE100+ 2000mm OD	2014 PE100 HSCR 2500mm OD	2020 PE100 HSCR/ Extra Low Sag 2800mm OD

Courtesy of Borouge Pte, Andrew Wedgner, PPXIX conference

Pipe Standards Evolved this Millenia

ISO 4427: 2007

PE100	PN10	PN8	PN6	PN5	PN4
Nominal OD	SDR17	SDR21	SDR26	SDR33	SDR41
	Wall thickness [mm] = e (max)				
1800	116.6	94.4	76.2	60.1	48.3
2000	129.5	104.9	84.7	66.8	53.8
2250	-	-	-	-	-
2500	-	-	-	-	-
2800	-	-	-	-	-
3000	-	-	-	-	-

ISO 4427: 2019

PE100	PN10	PN8	PN6	PN5	PN4
Nominal OD	SDR17	SDR21	SDR26	SDR33	SDR41
	Wall thickness [mm] = e (max)				
1800	116.6	94.4	76.2	60.1	48.3
2000	129.5	104.9	84.7	66.8	53.8
2250	-	118.1	94.8	75.9	60.7
2500	-	131.2	105.2	84.3	67.5
2800	-	146.9	117.8	94.4	75.5
3000	-	157.3	126.2	101.1	80.9

New PE100 Moulding Compounds

- Now possible to mould one piece DN630 90 degree Elbows
- Eliminates Fabricated Sectional de-rated bends

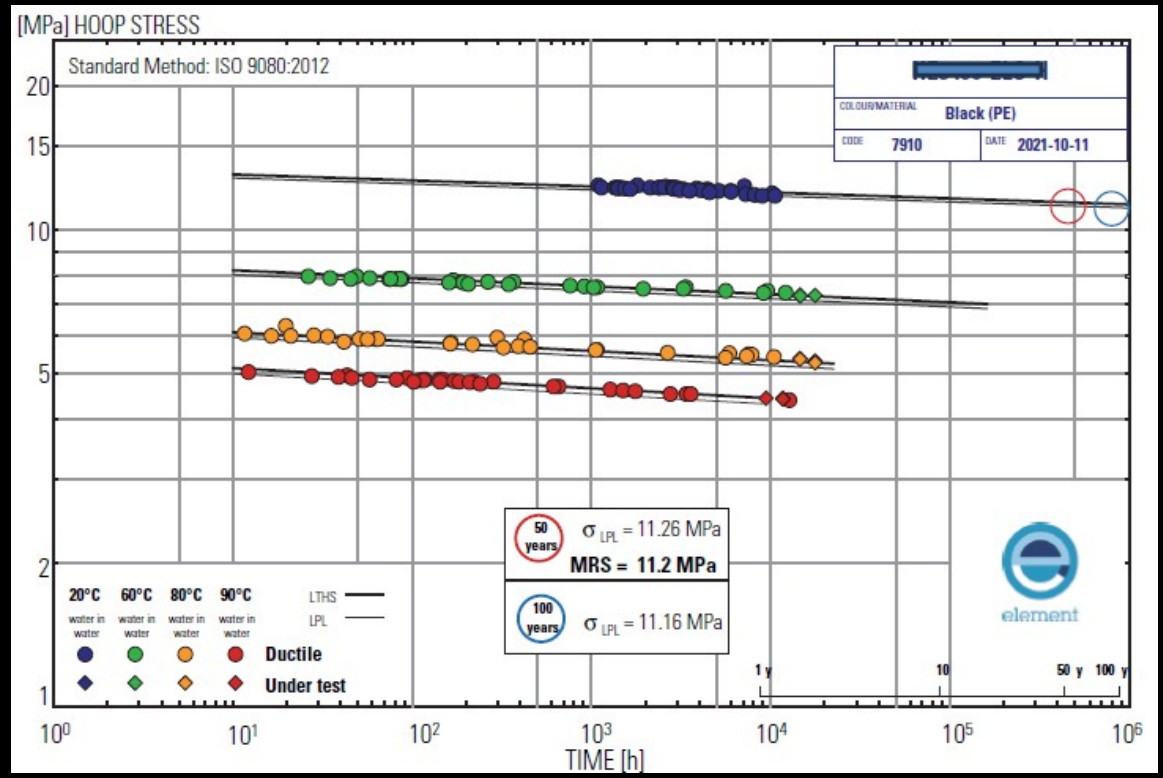
Image courtesy of PSEngineering

Polymer Compounds Enabling new Dimensions

Image courtesy of PS Engineeriing

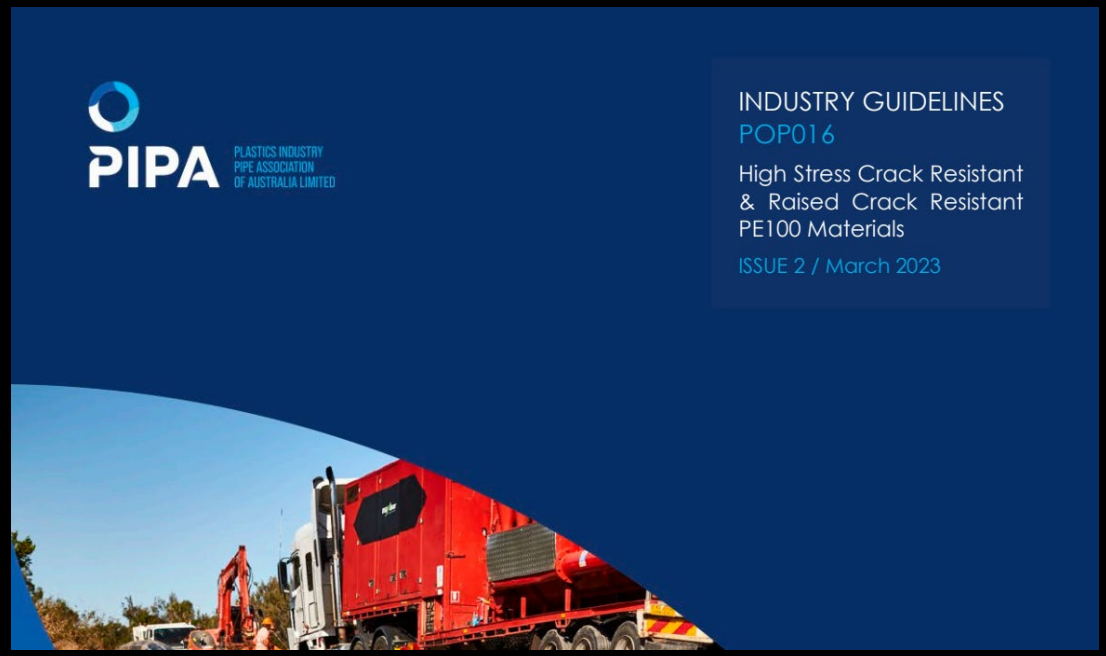
Higher Hoop Stress PE100 Compounds Now Available

- MRS of 11.2 MPa
- Increased Factor of Safety for design



PE100-RC now defined in Standards

- BS EN 1555-2:2021 “Plastic Piping Systems for the Supply of Gaseous Fuels”
- BS EN 12201-2:2011 “Plastic Piping Systems for Pressure Water Supply” is next for redrafting
- www.pipa.com.au POP004 Technical Guidelines lists qualified materials, while POP016 defines the parameters



AS/NZS Development

Significant changes proposed from the 2008 version

DR AS/NZS 2033:2023

Draft

Australian/New Zealand Standard™

Public Comment is invited for:

DR AS/NZS 2033:2023, Installation of polyolefin pipe systems

During their development process, Australian/New Zealand Standards are available in draft form during the public consultation period to allow any interests concerned with the application of the proposed Standard to review the draft and submit their comments.

This draft is liable to alteration. It is not to be regarded as an Australian/New Zealand Standard until finally issued as such by Standards Australia/Standards New Zealand.

Upon successful conclusion of the Public Comment period it is proposed to publish this Standard as AS/NZS 2033:202X.

Some of the major changes in the Draft

A Polyolefin Standard

- **Includes Polyethylene, Polypropylene, X-Linked PE, Polybutylene**

Design

- Seismic Risk
- Disinfection
- Effects of Sunlight
- Surge and fatigue

Hydrostatic Pressure Testing

- Covers Elevation and Temperature differences when testing

Installation

- Engineered Structural Design clause
- Addresses Trenchless Technology and relevant standards

The most significant change…

Section 5:

Jointing Requirements

- Competency and Training is stipulated for Fusion Jointing

Section 5: Jointing

In Australia, the competent person shall have completed PMBWELD 301/ 302 training within the last three years.

In New Zealand, the competent person shall have completed PMBWELD 301 / 302, or other training approved by the relevant authority, *(e.g. US31524, US31525 & US31532 by NZQF*) within the last three years.

Current Training is Ad-hoc

May or may not be in accordance to Unit Standards

Lacks graduation by size & SDR

Little or no field assessment and Supervision

PIPA worked with Connexis to develop these Unit Standards to the NZQF

Elective strands of Level 4 Diploma include 33 credits for Fusion Jointing available as Micro-credentials

There are no shortcuts:

Operators who do not conform to these training requirements should not be performing fusion joints

The Implications to The Industry

PROOF OF TRAINING

IS IT CURRENT

HISTORY OF COMPETENCY

What does competency look like

DR AS/NZS 2033: 2023 specifies that all weld samples are to demonstrate ductile fracture behaviour and strength of not less than 90% of the parent pipe

A field fusion QA plan shall be submitted and approved before jointing commences

Examples of Competency…

Image courtesy of Iplex NZ

Image courtesy of Iplex NZ

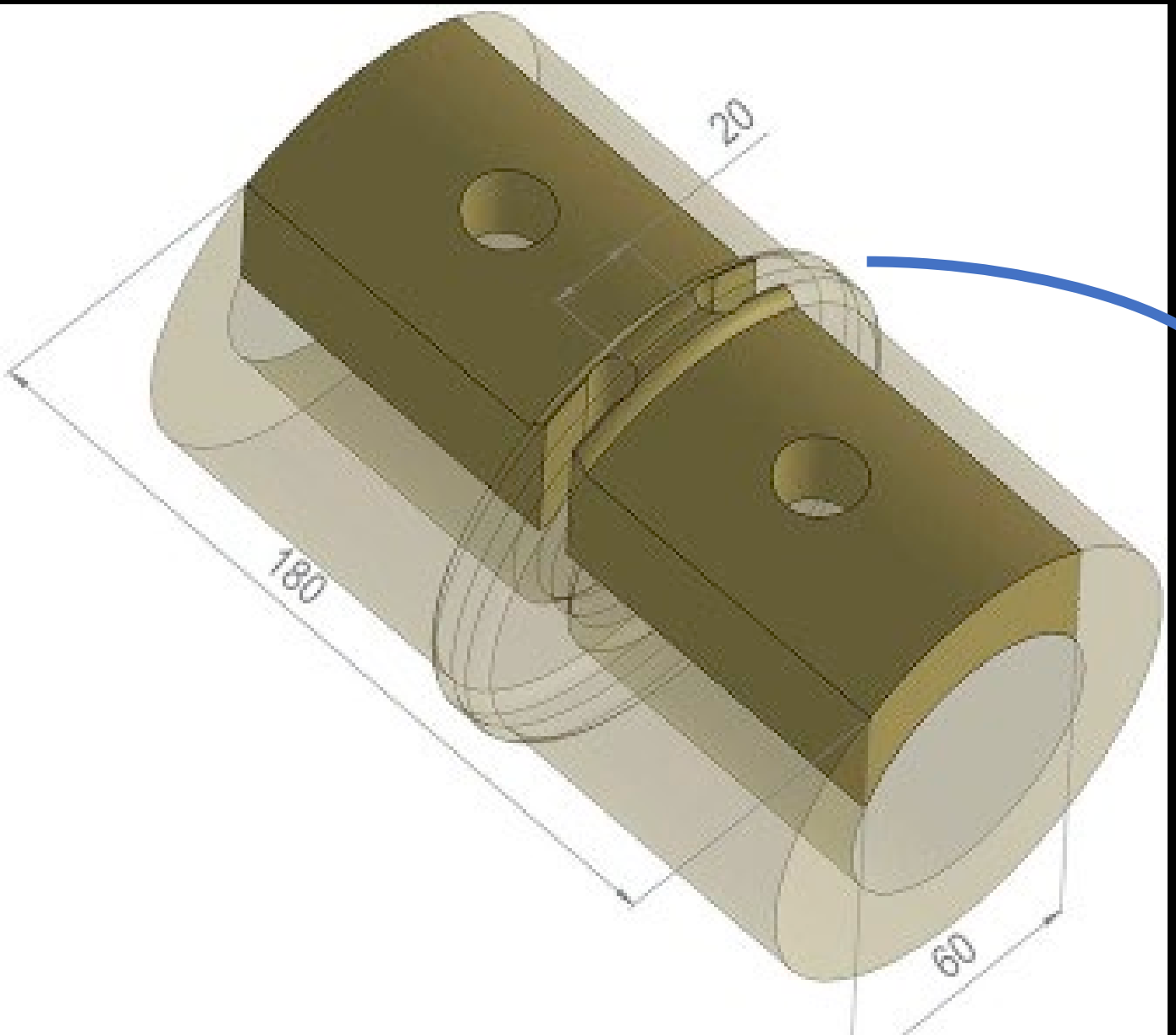
Examples of Competency

Image courtesy of Iplex NZ

Fusion Practice records

- Ultimately “Competency” will need to be recorded
- Welding Practitioner registration is inevitable
- AS/NZS 2033 is a critical standard – adherence to the proposed changes will drive collaboration among all stakeholders

ISO13953 preparation



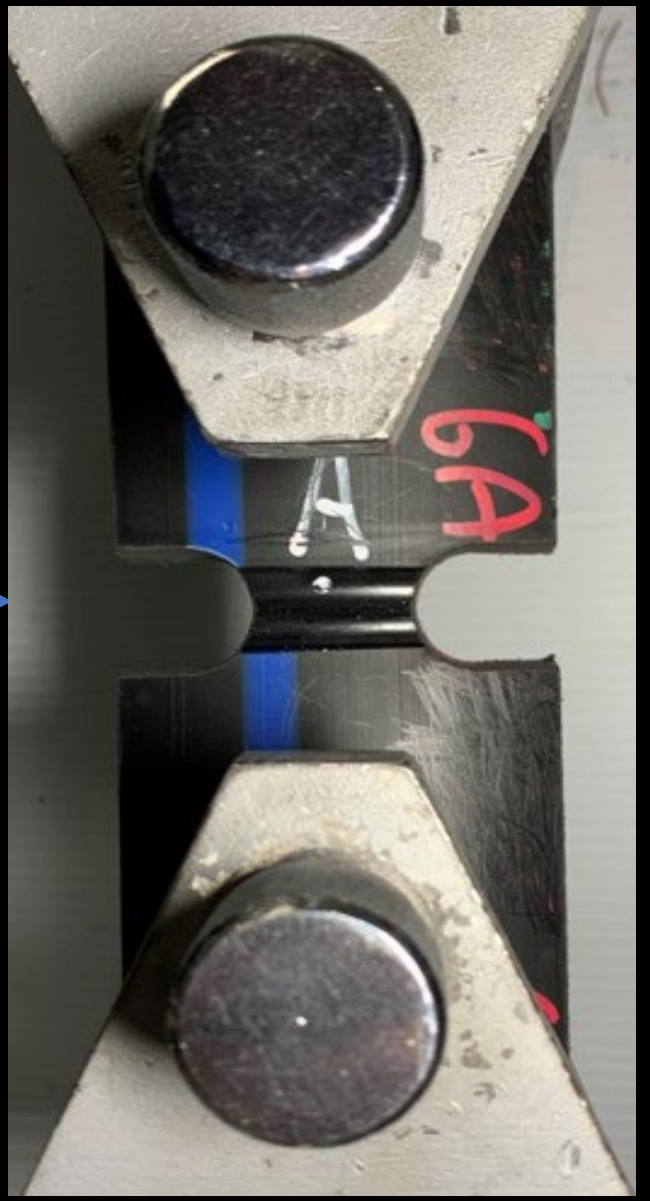


Image courtesy of Waters & Farr

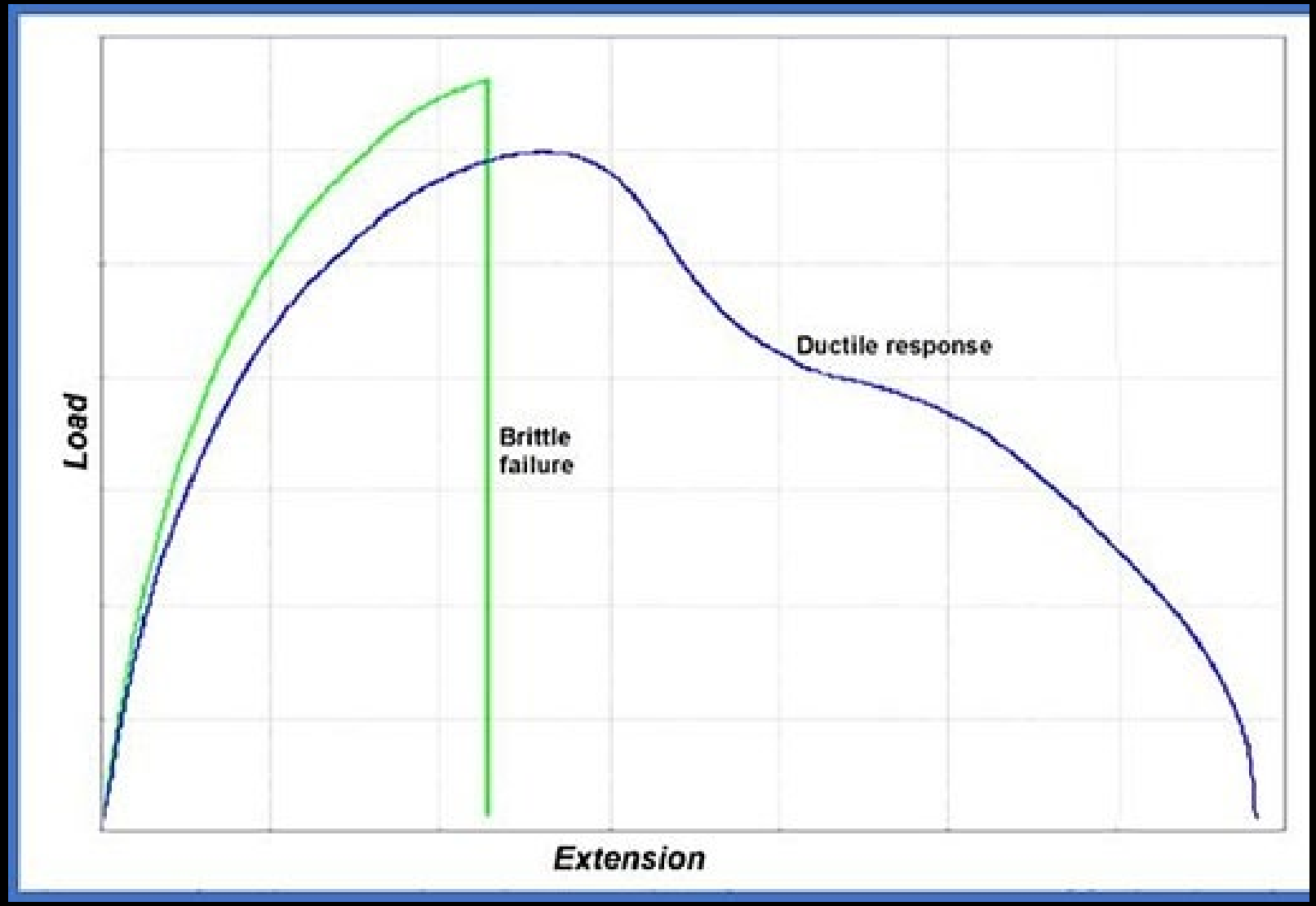
Images courtesy of Waters & Farr

Ductile

Brittle

Interpreting Ductile Failure

- A Load vs Extension graph will show a visually clear distinction between brittle and ductile outcomes
- This distinction can be difficult to determine from visual inspection of the weld surfaces alone



The Costs of Incompetence…

And where do we see it?

What Electrofusion Faults Look Like

Image courtesy of Iplex NZ

What A Fusion Bead Fault Looks Like

What Faulty Technique Looks Like

Images courtesy of Iplex NZ

What Dangerous Technique Looks Like

Images courtesy of Iplex NZ

We all want Safe and Enduring Infrastructure…

We all have a part to play in getting there

Designers

Pipe Makers

Installers

Supported by correct training and trade practise

Adherence to newly evolving Standards will be a critical part of the journey.

End of presentation

Thanks for listening – any questions