DEVELOPMENT OF A NZ PE PIPE INDUSTRY GROUP AND ASSOCIATED FUSION OPERATOR CERTIFICATE OF COMPETENCY

Blair Telfer (CPEng), Mott McDonald and member of PIPA (NZ)

ABSTRACT

The versatility and properties of Polyethylene pipe have resulted in a substantial increase in its use for 3Water projects and applications over the past 10+ years. As its use has become more widespread and accepted, alongside technological improvements in the pipeline material and fittings, the need for improved quality assurance and education has increased.

To this end the Polyethylene Pipelines Industry Group (PPIG), under the umbrella of PIPA NZ, a sector group of Plastics NZ, was established in 2015. This paper will summarise the development of this group, its key goals and vision as well as the work undertaken to date in the creation of a Certificate of Competency (CoC) for PE fusion welders.

The PPIG includes all of the key NZ PE industry players, including material suppliers and pipe and fittings manufactures and suppliers, has a constitution and governance structure as well as being affiliated with PIPA Australia. The Group supports all industry participants including asset owners, specifiers, engineers, contractors and suppliers to ensure PE pipelines are correctly designed, specified and installed. The end goal being to provide added value to the end users of polyethylene pipelines and fittings in NZ.

One of the key goals the group set for itself for 2017 was the development and introduction of a National Competency Register and re-certification scheme for all polyethylene fusion welding technicians. The intent and current status of this scheme will be described as well as any future steps to be undertaken.

The paper will also describe the next upcoming goals and challenges that the group has set for itself for 2017 & 2018.

KEYWORDS

Polyethylene, quality assurance, education, Certificate of Competency (CoC)

1 INTRODUCTION

Polyethylene (PE) was discovered by accident, in 1933 by researchers at ICI in UK. When the temperamental process was finally held under control, the industrial output that resulted became a hero of WWII, as it was used to insulate Radar cables both ground level and on fighter aircraft – a revolutionary secret of the Allied Forces. By 1953, "HDPE" was discovered and by the end of 1954, Hoechst AG had extruded HDPE pipes undergoing hydrostatic test – these are still in test mode today. However it should be noted pipes are not the only product that polyethylene is used, in fact it is so widespread in everyday use that you probably don't even realise many of the daily products you use

that include or are made from polyethylene. Hip and Knee replacement surgery has relied on PE implants now for over 40 years. It's inert, reliable and doesn't break down.

Amongst many properties, it is polyethylene's viscous-elastic nature and ability to be fused (welded) to itself that have made it a widely used pipeline product. The Gas Utility Sector in most countries were notable early adopters of PE pipe systems for its many attributes. Fusion was key there. The advent and uptake of trenchless pipeline installation has also increased the use and popularity of polyethylene.

In New Zealand (NZ) its use has risen steadily from the late 1990's through the 2000's to today in 2010's.

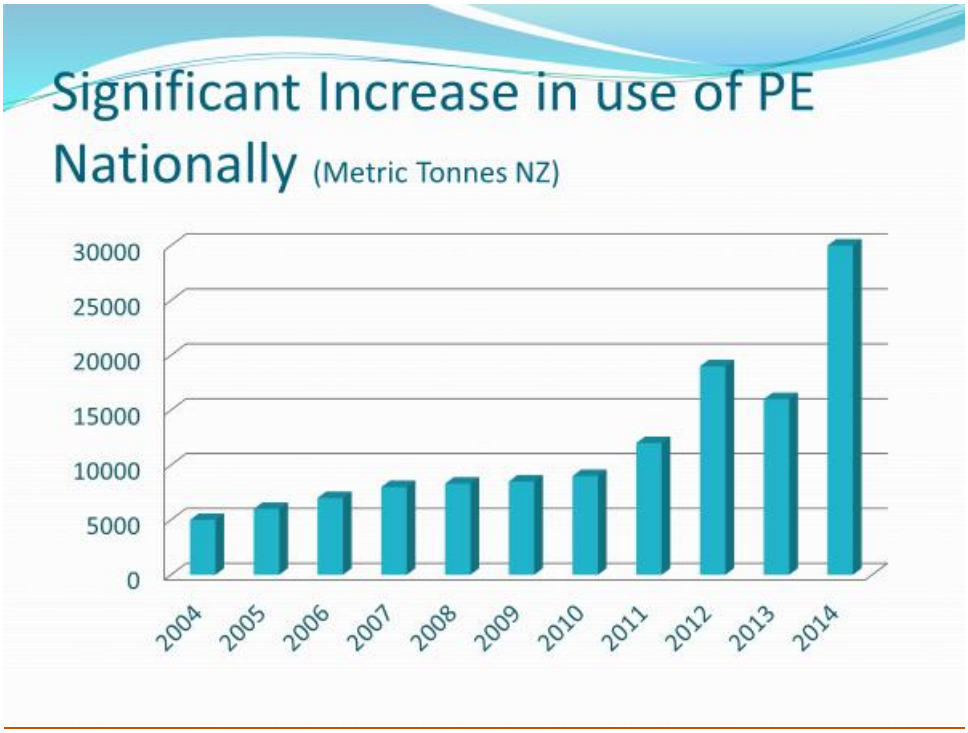

Table 1: Increase in Use of PE

Note – this includes both PE as used for gas & irrigation as well as 3Water, sewer, storm and potable, pipelines.

On going research and development of polyethylene as a product in general and as a pipeline material in particular, continues to ensure it is eminently popular. Some of the latest incarnations of the material include PE100 RC, a high strength, slow crack propagation material, as well as greater wear characteristics for slurries and new resin being developed that allow thicker wall pipes to be produced.

Furthermore as the world's ecology becomes a greater global issue, producers have been compelled to study the overall Lifecycle Assessment [LCA] of their material. PE pressure pipe has been proven to exhibit 19% of the environmental impact of a ductile iron pipe.

2 BACKGROUND TO THE FORMATION OF PIPA NZ

As the use/uptake and size (630mm to 900mm OD now is not unusual) of PE pipeline installation increased over the past years, at times, the quality of the installation has not kept pace. This has manifested in a few project issues. For all of its great properties, PE, just like any other material or fitting, is only as good as it's installation. Without good quality assurance processes and procedures, the true value and worth of the

material will not be realised. This is no different to PVC, steel or ductile iron pipe and fitting installation.

As a result of the poor perception of PE from these project issues, a number of the key players in the NZ PE industry, including pipe and fitting manufacturers, put aside their competitive commercial interests and agreed that a national industry body was required to promote the good use of PE pipe and fittings. And so PIPA NZ was created.

It was quickly agreed that in order for this group to be relevant and seen by the industry to be independent it needed to be not just a group of interested parties but a nationally recognised industry group. As such Plastics NZ was approached such that the group could be incorporated within its overarching structure. It should be noted that a similar PVC group had existed under Plastics NZ since 1995. Similarly PIPA Australia (Plastics Industry Pipe Association of Australia) had existed since 2002, after a split form PACIA in 1999. It too had been established for the same reasons, to "promote the correct use and installation of safe and environmentally responsible plastics pipe systems". It was clear that NZ wasn't specifically any different to Australia and therefore both institutions should be aligned. A quick phone call to PIPA Australia ensured their support and agreement that all of their resources could be used.

The first meeting of the new NZ polyethylene industry group, PIPA, was held at Plastic NZ offices on 4th June 2015 and attended by 12 individuals from various PE parties.

3 STRUCTURE AND PURPOSE OF PIPA NZ

Today PIPA NZ has 15 participants representing the bulk of the NZ PE industry. See Appendix A for a list of all of the incorporated parties. To ensure openness and robustness a Code of Conduct and Conflict of Interest excluding any commercial interests was prepared and signed by all participants. A Governance committee, developed on PNZ guidelines, was formed as well as a specific technical sub committee and a communications team.

One of the first critical decisions to be made and agreed was the groups mission & vision, as this would confirm overall direction and focus of the groups initiatives. After much discussion and debate it was agreed on "to ensure PE pipelines are correctly designed, specified and installed." This was agreed to be achieved through, training, education, national policy setting representation, as appropriate, and lobbying. Furthermore the Technical group was established to be an independent group that could answer questions or provide information on a technical issue without any commercial bias.

4 TRAINING AND EDUCATION – PE FUSION UNIT STANDARDS REVIEW

Quite co-incidentally but with very fortuitous timing the review of the Unit Standards for PE Fusion (welding) was being undertaken by the Motor Industry Training Organisation (MITO) who, from a historical perspective, are the Unit Standard 'owners'. The applicable unit standards are 25610 Demonstrate knowledge of equipment and operations for jointing polyethylene pipe for a network, 10980 Perform electrofusion jointing on polyethylene pipe for a network and 10987 Perform butt fusion jointing on polyethylene pipe for a network. This was fortuitous as the lack of currency and relevance of these unit standards had been identified by the group as one of the reasons for the poor installation quality processes being undertaken. The review allowed for the

group's suggested improvements to be addressed and included in the new standard version.

Key to the groups proposed improvements was a sized based classification reflective of the fact that fusion of a 20mm pipe or fitting was fundamentally quite different to fusion of a 630mm, albeit that the theory was the same, it is the logistics and process that is different. Updating the standards to today's best practice, from those of almost 10 years ago, when the standard was last reviewed, (Nov 2009) was also a prime output for the group. Unfortunately, MITO did not accept the groups proposed updates. This led the group to need to develop a size based national Certificate of Competency (CoC) and associated register of competent welders. It should be noted that this register is intended to only be applicable for 3Waters and over time, irrigation, as the gas industry, the other major user of PE welding and the unit standards, has their own register and process mandated by central government legislation.

5 DEVELOPMENT OF A NATIONAL CERTIFICATE OF COMPETENCY

As using the NZQA Unit Standards as a means of improving the quality installation of PE pipe was considered to not be effective, due to MITO not accepting the PIPA group's recommendations, the development of a size based national CoC was seen as the next best pathway to be investigated. To this end the input of Connexis, the Infrastructure ITO and nominated training institution for WaterNZ, post the dis-establishment of NZWETA in 2016, was requested. Connexis have been very supportive and co-operative in the development of the proposed CoC.

There are four key aspects to the CoC, namely:

- The NZQA Unit Standards of 25610, 10980 and 10987 being the base 'building blocks' of the CoC
- Additional theoretical content and training for those aspects considered to be necessary that aren't currently covered in the unit standards
- Demonstration and assessment of sized based field work in each discipline, Butt fusion and/or electrofusion (EF) fusion
- On going assessment of size based current competence once the CoC is awarded

This can simplistically be represented by the following diagram.

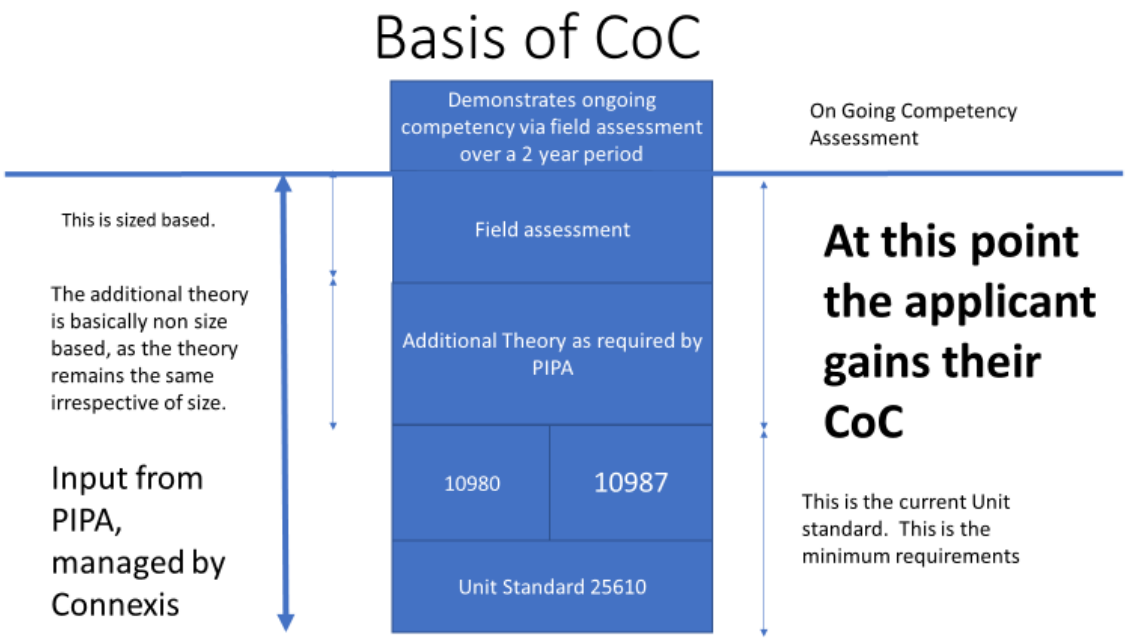

Fig 1 – Basis of CoC

6 OVERVIEW DETAILS OF EACH ASPECT OF THE CERTIFICATE OF COMPETENCY

6.1 **Unit Standards –** the one recommendation of PIPA through the unit standard review that was accepted was that Unit Standard 25610 'Demonstrate Knowledge of …' should be a pre-requisite of the application unit standards, 10980 for EF welding and 10987 for Butt welding. Attainment of the appropriate unit standards is the starting base requirement. This could be achieved through any MITO approved/endorsed training establishment/organisation.

6.2 **Additional Theory –** PIPA does not believe that the scope of training elements in the current unit standards fully discusses and describes the level of theoretical knowledge necessary to meet today's best practice in PE fusion. As such PIPA, in association/collaboration with Connexis, have developed additional training material to cover the 'gaps' in the unit standards. For a practitioner/welder to be eligible to be awarded the CoC this additional theoretical work must be undertaken from a Connexis endorsed trainer using the approved training notes.

6.3 **Field assessments –** PIPA believe that one of the key failings of the current unit standards is the fact that the standard is awarded after one simple weld is performed on a small diameter pipe and fitting. Fundamentally this allows a welder to pass the practical course in one day by providing a small diameter test weld, often/generally 63mm or smaller, that is visually examined for 'approval' and the next day undertaking a large diameter, 630mm or larger, weld. As part of the CoC the welder/trainee will need to undertake a number of welds in the presence of an assessor in the field (NB this could be in a contractor's yard or in the field under the tutelage of an 'experienced' welder). Moreover, these assessment will be applicable within size ranges for the different methods. In the case of Butt fusion the three size ranges are 20mm – up to 355mm, 355-up to 630mm and 630mm and above. For EF the applicable size ranges are 20mm up

to 280mm, 280mm to 450mm. There is no range for EF 430mm and over, this will be specific training provided by the Fittings manufacturers.

The field assessment will review the practices undertaken by the welder as well as the destructive testing to the applicable ISO standard.

To obtain the CoC the trainee will need to 'pass' the theoretical component and the field assessment as well as preparing six welds that pass the ISO tests, with no failures.

6.4 On-Going Competency Assessment – to continue to be recognised on the NZ national register for current competency in a particular size and field the welder will need to supply 12 test welds, over a 2 year period, that pass the ISO destructive test. A maximum of two test fails with appropriate root cause investigation is permitted. It is expected that these test results will be undertaken during the course of their work for a water authority and not additional. Weld test results will be augmented by 'random' field inspection assessments.

6.5 National Register of Competent Practitioners – successful award of the CoC and on going proof of current competency as noted previously will result in the welders details being published on a national register. Here again Connexis have agreed to administer this register. It should be noted that no personal details of the welder will be shown, merely their NZQA qualification number. The idea being that a water authority can verify that a welder nominated for any particular project has been assessed as being competent.

6.6 Future Vision for the CoC – although PIPA and Connexis are the two key parties in the current development of the CoC it is ultimately seen as being 'owned' by the NZ PE industry. To this end once the CoC is established, it is envisioned that a governance committee with representatives from NZWater, PIPA NZ, Training Organisations, including Connexis and NZCF will be established. This governance group will ensure that any update or development of the CoC meets the industry's needs.

7 NEXT IDENTIFIED ASPECTS FOR ACHIEVING HIGH QUALITY PE INSTALLATION

As much as the development of the CoC is seen as being a critical aspect for raising the quality standard of PE welding and this is a crucial aspect of overall PE pipe and fitting installation, it is not the only aspect. As such, the following areas have been identified by PIPA as needing development and nationwide implementation. These are the proposed next stages of training and education to be focussed on:

7.1 Development of a Standard Specification for the use of PE – there are a number of key aspects that make up PE pipe installation best practice. PIPA shall/proposes to prepare a standard specification for the use of PE pipe and fittings that can be shared and used by all water authorities. Note this will only be for the use of PE, the actual installation method specification i.e. open trench, Horizontal directional drilling, pipe bursting etc, will still need to be developed by the water authority.

7.2 Training for PE installation Field Supervisors – a number of agencies have noted that as well as welders needing to improve their quality practices so to do field supervisors need more training to know what to look for in the field. This will include what does good practice look like and what are the appropriate and applicable standards and tests that should be undertaken. This will be cross

referenced to the development of the contract specifications noted in 7.1, as the two aspects are clearly inter related.

PIPA is very happy to receive any other ideas from the NZ PE industry as to areas that are required to be improved/developed.

8 CONCLUSION/SUMMARY

PE pipe is accepted as being an indispensable pipeline product within the NZ 3Water field, not only for its seismic resistance properties but for its application in trenchless installation as well as its other beneficial properties eg reduced cyclical loading fatigue. However poor installation of the pipe and/or fittings reduces the value/benefit of any installation meaning that the expected 100 year plus lifetime is less likely to be achieved/realised.

PIPA NZ an industry group that represents the major 'players' in the NZ PE market place has been formed to educate and promote best practices in PE installation to ensure high quality end products.

PIPA NZ's first prioritisation is the development of a national CoC and register of PE welders. This is intended to be followed up with additional training and education in the development of a national specification for the use of PE and training certification for field supervisors.

PIPA NZ is pleased to hear from any aspect of the NZ PE industry on other areas it feels are necessary to be developed.

APPENDIX A – CURRENT MEMBERS OF PIPA NZ POLYETHYLENE GROUP

- Georg Fischer Ltd
- Huerner Welding Technology NZ Ltd
- Interplas Agencies Ltd
- Iplex Pipelines Ltd
- Mott MacDonald Ltd
- Plasson Australia Pty Ltd
- Ravago NZ Ltd
- Strata Plastics
- TCL Hunt Ltd
- The Aliaxis Group Ltd (Friatec, Marley NZ Ltd and RX Plastics Ltd)
- The Asmuss Group (Asmuss Plastic Systems, Asmuss Water Systems)
- Waters & Farr