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# RedSpace: Innovation Case Study 10
# Australia's gas industry – solving problems with gas pipelines

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## 1. Snapshot

TAFE Queensland SkillsTech (TQST) was the driving force in the research and identification of a critical gap in the training of High Density Polyethylene (HDPE) welders for the coal seam gas (CSG) domestic and export markets, which led to the establishment of the HDPE Training Centre of Excellence.

## 2. Research team

Danny Platt, Business Manager Plumbing, TAFE Queensland SkillsTech
Garry Hargreaves, Manager Commercial Business Services, TAFE Queensland SkillsTech
Mark Holmes, National Manager Water & Gas Utilities, Georg Fischer.
Michael Doyle, National Business Development Manager, Iplex

## 3. Background

The extracting, transporting and converting CSG to liquefied natural gas (LNG) represents an opportunity for the state of Queensland and requires critical thinking for a range of skill sets in the welding of hundreds of kilometres of large scale diameter HDPE pipelines. These pipelines are used to transport gas from the well head for separation, drying and compression. Typically these lengths of large diameter pipe are welded together, generally by butt fusion and to a lesser extent by electrofusion, to form a continuous sealed pathway for transfer purposes.

After hydrostatic or nitrogen testing (nitrogen is evacuated from the atmosphere), the pipe is buried up to 1.5m into the earth. With the natural movement of the ground or the transport of machinery, the pipeline can undergo stresses that if not welded correctly, can cause the weld joints to crack releasing potentially harmful methane gas. This leads to loss of product, environmental concerns and a loss or reduction of upstream production.

One such leak occurred in the Western Darling Downs region of Queensland in the early testing phase of the gas pipeline gathering system. This raised the level of concern in the gas industry about the HDPE product risk and associated environmental safety hazards. As a result, the joint failure was analysed by international experts and it was determined that user error (sunscreen in the joint) was to blame rather than a HDPE product failure.

Early discussions with the gas industry revealed a lack of training standards in the welding of HDPE, with many welders having little or no formal training or understanding of issues triggered by handling, preparation or environmental conditions of the polyethylene. TQST recognised that a lack of formalised training processes and procedures may also be responsible for other major failures in the installation of HDPE pipe such as electro fusing saddles onto the HDPE pipe and saddle technology faults.

**4. Challenge**

With industry support TQST responded to the challenge to meet this training gap by offering high quality HDPE welding training to the gas industry.

While TQST educators had significant expertise in the small diameter HDPE welding required for training gas and plumbing students, they did not have the skills, equipment or resources required to deliver training on large diameter, high pressure HDPE pipe welding. This prompted TQST to partner with international HDPE suppliers Georg Fischer and Iplex Pipelines who were both keen to address the gas industry perception of their product risk.

Around the same time Industry bodies and stake holders in gas projects had also recognized similar problems and required a higher level of security for the installation of large scale PE100 pipe lines. As a result the Australian Pipeline and Gas Association, (APGA), championed the development and introduction of a Code of Practice. This has since been legislated in Queensland and consequently forms the basis for all aspects of PE welder training.

During the development of the Code of Practice, SkillsTech actively provided technical consultation and practical examples to the various steering committees for the qualification of training methods associated with PE welding. This had the dual accomplishment of allowing the SkillsTech training programs to reflect exactly the high standards set down from industry requirements.

*The Code of Practice will continue to evolve to incorporate other practices within this field, and as companies like George Fischer introduce innovations to enhance both security and safety in product design, SkillsTech remains pivotal in maintaining up to date training programs and facilities meeting the flexible demands from industry.*

Mark Holmes, Georg Fischer

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## 5. Study

Integral to the success of this partnership was the co-location of Georg Fischer and Iplex Pipelines to TQST's Acacia Ridge training centre to establish the HDPE Centre of Excellence. The roles and responsibilities of this Centre are:

- Georg Fischer – to provide welders, hardware and hot tapping equipment
- Iplex Pipelines – to provide all student materials
- TQST – to provide workshop facilities, teachers and regular field trips to the Western Darling Downs for verification of competency assessments on live gas and water mains

The Centre of Excellence serves primarily as TQST's student training facility and also as a demonstration/briefing venue for Georg Fischer and Iplex Pipelines clients and the gas industry. New or updated equipment is regularly rotated through the Centre. This ensures that students are always training on the latest equipment and that teachers' skills are constantly at the forefront of industry requirements.

The establishment of the HDPE Centre of Excellence enabled TQST to offer the following industry solution to improve the quality of HDPE welding:

- HDPE welding training that was aligned to the Australian Pipeline Industry Code of Practice for Upstream PE Gathering and the Plastic Industry Pipe Association of Australia Industry Guidelines
- HDPE welding training on the latest industry equipment
- Theory based programs as well as a wide range of potential faults and problem solving techniques. Participants are also paired up to weld a range of pipeline diameters in various conditions that simulate on-the-job conditions
- Compulsory revalidation of industry competencies every two years
- Provision of an ID card to graduating students with details of their level of qualification

## 6. Findings

This training has been positively received by industry to the extent that several of the major gas providers within the industry do not permit workers onsite until this training has been undertaken.

More significantly, the commitment to improve the quality of HDPE welding has also identified a strong industry demand for improved skills in hot tapping and squeeze off of HDPE pipe. This is non-accredited training. Squeeze off is a popular means of shut down for the repair of damaged HDPE pipelines. However, the very nature of this task means that it can be extremely dangerous with high risk factors for employees and the environment

TQST tested the skills of nine QGC employees who had previously completed a one day course in hot tapping and squeeze off with another registered training organisation. Eight of the nine employees failed the test, leading QGC to seek recommendations from TQST on how this training could be improved. As there was no recognised training program, TQST developed a training program in accordance with industry guidelines and recommended that QGC send their staff to TQST for RPL and gap training. This recommendation was accepted by QGC and the training was successfully delivered within QGC's 30 day timeframe.

Gas employees are now trained in the skills required to electrofuse saddles to HDPE pipe. This allows:

- branch lines from live gas wells to be tapped into live gas mains
- high level vent lines to be to be tapped into live water mains to remove gas
- low level vents to be tapped into live gas mains to drain excess water away.
- Verification of this skill set on site on live mains.

## 7. Outcomes

The outcomes of this training are:

1. The HDPE welding, hot tapping and squeeze off training delivered by TQST's Centre of Excellence is regarded as best practice by major companies in the gas industry (QGC, Origin, Leighton and Murphy Pipe and Civil)
2. TQST's HDPE Centre of Excellence has been instrumental in the introduction of a Code of Practice for this industry. This has since been legislated in Queensland and consequently forms the basis for all aspects of PE welder training
3. Significant reductions in weld failures resulting in positive impacts on product loss rates (There have been no reported notifications of any weld failures following training)
4. As a quality assurance measure weld quality is now comprehensively monitored by gas companies. Employee numbers and GPS co-ordinates are recorded for each weld
5. Key additions to the PMB30107 Certificate III in Polymer Processing training package with participation and input to safety and development of work method statements in conjunction with industry
6. Apprentices and trainees can now access this training as part of plumbing and gas training courses.
7. CSG workers can now qualify for two HDPE welding units of competency, butt fusion welding and electrofusion welding with new training courses developed and delivered in hot tapping (drilling live mains to bring in new gas wells) and squeeze off to enable repair of damaged pipe work

The knowledge and experience gained from this training has expanded TQST's capability to take on more challenging and innovative training opportunities. This training has now been delivered to local government in Tasmania. TQST is also exploring the potential for this training to be replicated in other industries such as sewerage, irrigation and water.

## 8. Reflections

This project has demonstrated the value of systematically monitoring gas industry trends in helping to forecast industry needs and plan for future training programs. However, it has also shown that such observations need more detailed discussions with the industry to accurately identify the real issues. Partnering with the gas industry to offer training then ensures ongoing industry relevance. The resulting courses are often ahead of industry training packages and can input into their updating. Such investment in training can be risky, but also has the potential to position the partners as innovative thought leaders:

> *Prior to training being introduced, there were regular HDPE weld failures due to poor installation. Enforcing specific training processes has led to product risks being reduced and a significant improvement in welding success. Electrofusion is now widely accepted by the gas industry, and training programs are now being developed in support of the industry code of practice requirements.*
>
> Mark Holmes, Georg Fischer

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**9. Notes**

Thanks to Danny Platt and Garry Hargreaves for this case study. They can be contacted on:
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