CASE STUDY

STABILISING AND LEVELLING AGL INFRASTRUCTURE WITH RSJ170 EXPANDING RESIN

Site Profile

The Wallumbilla LPG Facility owned by AGL is located approximately 13 km south of the township of Wallumbilla, in the Darling Downs region of Queensland. The gas hub is a major transit centre for natural gas in Eastern Australia, with existing infrastructure and trade connecting multiple markets. The land in the vicinity has weathered, lowland sediment soils characterised by duplex soils and cracking clays.

Figure 1. The Wallumbilla LPG Facility

The Situation

AGL's lead Mechanical and Reliability Engineer noticed stress cracking and subsidence on some of the slabs that supported key infrastructure. The sunken infrastructure included a butane storage bullet, a propane storage bullet, six electric motors and pumps, and interconnecting pipework, which were all supported on concrete plinths.

A laser survey was used to measure and document the differences in plinth and piping elevation. Misalignment caused interconnecting pipe flange joint gaps to be uneven and this was measured against ASME PCC-1 guidelines.
If left untreated the area would be unsafe and potentially unusable.

Conventional solutions considered were to:

- underpin plinths and realign pipe work.
- remove and replace the foundations and plinths and realign pipe work.
- relocate plinths and equipment and re-route piping and cabling.

All the above three options were possible but coupled with more downtime, were significantly more costly. AGL sought a more cost-effective and non-invasive solution.
The Resinject Structural Consultant concurred that there was subsidence across this area of the site.

Our Solution

Resinject provided a scope of works that had two main objectives, deliver a long-term solution to help strengthen the ground to prevent further subsidence and re-level the foundations by void filling under the slabs to remove any differential settlement.

Resinject proposed a tailored deep penetration solution to raise and stabilise the overlaying infrastructure using RSJ170 which is a unique two-in-one ground improvement and re-leveling solution that is a cost-effective and long-term solution. The level correction work would be continuously laser measured to within a tolerance of +/-1mm during the job.

The solution also needed to safeguard the structures from damage and over-lift and reduce any risk of harming personnel. AGL conducted a Job Risk Assessment which was attended by the AGL Lead Mechanical Engineer, AGL Asset Integrity Engineer, AGL Structural Engineer, a third-party Principal Structural Engineer engaged by AGL, and by Resinject.

RSJ170 was injected into the ground beneath the concrete plinths at multiple different depths

STABILISING AND LEVELLING AGL INFRASTRUCTURE WITH RSJ170 EXPANDING RESIN

ranging from 1.5m and 2.5m depths, targeting the problem areas in a grid-like fashion with 1.2m spacing across the surface area to ensure even distribution. The injection points for this treatment were targeted at these deep depths to provide strength and support for the overlaying infrastructure.

The expanding polyurethane resin mix is injected through very small tubes. On entering the ground, the components mix and expand by chemical reaction, strengthening the ground and re-leveling the treatment area quickly with minimal disruption.

Resinject worked closely with AGL engineers to ensure the works were undertaken in a controlled, monitored, and transparent manner.

Figure 2. A Resinject operator completing the resin injection methodology

The Results

At the completion of the works, Resinject had successfully raised the concrete plinths, by up to 30 mm, filled the underlying voids, and compacted the foundations, to ensure a robust and enduring support structure remained for future heavy loading.

The works were completed over the course of three-days and during the planned shutdown which minimised the disruption to facility and operations. The collaboration between Resinject and AGL ensured the mitigation of risk and safety for personnel and the site.

Several months following the conclusion of the project, AGL organised an independent laser survey to validate the post-treatment concrete plinth elevations. Appendix 1 outlines the results from the independent survey.

AGL were delighted with the results, the efficiency of the service delivery and especially the response to safety given the nature of this project.

Testimonial

“To complete this job in the way that we have done is a huge achievement! The three-day job was completed safely, with no HSE incidents noted, and the job was completed one day ahead of schedule and within budget. Excellent estimating from your end Richard. Significant savings were made by successfully using this resin injection option. I can foresee others within or outside the company who are considering resin injection to lift and level process equipment, to do so with considerably more confidence in the future.”

CASE STUDY

STABILISING AND LEVELLING AGL INFRASTRUCTURE WITH RSJ170 EXPANDING RESIN

Appendix 1| Propane and Butane Bullet and Pump plinths - Clarification of levels after resin injection treatment.

Measure and record relative level of the North and South underside of the

i. Propane Bullet (2 points)

Propane bullet – Underside of Vessel	RL	Difference
1. North	306.1	**-0.003**
2. South	306.1	

ii. Butane Bullet (2 points)

Butane bullet – Underside of Vessel		Difference
1. North	306.1	**-0.001**
2. South	306.1	

- **Measure and record relative level of top of the 4 corners of**

i. Propane Bullet concrete plinth fixed metal baseplates (Northern and Southern Plinths)

ii. Propane Bullet Southern concrete plinth sliding metal baseplate

Propane Bullet Northern Concrete Plinth – Top of FIXED metal baseplate	RL	Corner Elevation Difference	Propane Bullet Southern Concrete Plinth – Top of FIXED metal baseplate	RL	Corner Elevation Difference	Propane Bullet Southern Concrete Plinth –	RL	Corner Elevation Difference	Sliding Plate minus respective Fixed Plate Corner	Fixed and Sliding Plate Corner Gap (minus plate 25mm
1. SW	305.9	-0.002	1. SW	305.841	**-0.003**	1. SW	305.9	-0.001	0.028	0.003
2. NW	305.9	**-0.004**	2. NW	305.841	**-0.003**	2. NW	305.9	**-0.003**	0.026	0.001
3. NE	305.9	-0.001	3. NE	305.841	**-0.003**	3. NE	305.9	-0.002	0.027	0.002
4. SE	305.9		4. SE	305.844		4. SE	305.9		0.026	0.001

iii. Butane Bullet concrete plinth fixed metal baseplates (Northern and Southern Plinths)

iv. Butane Bullet Southern concrete plinth sliding metal baseplate

Butane Bullet Northern Concrete Plinth – Top of FIXED metal baseplate	RL	Corner Elevation Difference	Butane Bullet Southern Concrete Plinth – Top of FIXED metal baseplate	RL	Corner Elevation Difference	Butane Bullet Southern Concrete Plinth –	RL	Corner Elevation Difference	Sliding Plate minus respective Fixed Plate Corner	Fixed and Sliding Plate Corner Gap (minus plate 25mm
1. SW	305.9	-0.001	1. SW	305.835	-0.002	1. SW	305.9	-0.001	0.032	**0.007**
2. NW	305.9		2. NW	305.837		2. NW	305.9		0.031	**0.006**
3. NE	305.9	-0.003	3. NE	305.834	-0.003	3. NE	305.9	**-0.007**	0.027	0.002
4. SE	305.9	**-0.005**	4. SE	305.833	**-0.004**	4. SE	305.9	-0.006	0.029	0.004

- **Measure and record relative level of the top of the 4 corners of**

i. 3 x Propane Pump concrete plinths

P-111A Propane Rundown Pump – Top of Concrete Plinth corners	RL	Corner Elevation Difference	P-111B Propane Rundown Pump – Top of Concrete Plinth corners	RL	Corner Elevation Difference	P-113 Propane Booster Pump – Top of	RL	Corner Elevation Difference
1. SW	304.1		1. SW	304.045	-0.005	1. SW	304.1	-0.001
2. NW	304.1	-0.001	2. NW	304.05		2. NW	304.1	**-0.002**
3. NE	304.1	**-0.003**	3. NE	304.045	-0.005	3. NE	304.1	
4. SE	304.1		4. SE	**304.04**	**-0.007**	4. SE	304.1	-0.001

ii. 3 x Butane Pump concrete plinths

Note: All Plinth Top corners to be numbered (1-SW, 2-NW, 3-NE, 4-SE)

P-112A Butane Rundown Pump – Top of Concrete Plinth corners	RL	Corner Elevation Difference	P-112B Butane Rundown Pump – Top of Concrete Plinth corners	Corner Elevation Difference	Difference	P-114 Butane Booster Pump – Top of	RL	Corner Elevation Difference
1. SW	304.2	**-0.001**	1. SW	**304.2**	**-0.006**	1. SW	304.2	-0.001
2. NW	304.2		2. NW	304.202	-0.005	2. NW	304.2	
3. NE	304.2	**-0.001**	3. NE	304.207		3. NE	304.2	**-0.006**
4. SE	304.2	**-0.001**	4. SE	304.205	-0.002	4. SE	304.2	-0.002

Source: Lead Mechanical Engineer, AGL, November 2023.