

# Transitioning a hydrogen facility from project to operations

Gregory J Chrisfield

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## ABSTRACT

Preparing any hazardous facility for transition from project to operations requires a rigorous management process. In the area of hydrogen operations, hazards are heightened and there are limited examples of transitioning a hydrogen facility from project to operations outside of large-scale oil refineries. This paper highlights the unique challenges of managing hydrogen process safety through the project to operate phase while maintaining safety standards that meet or exceed the expectations of the asset owner, regulator and the community in which we operate. Our experience transitioning hydrogen operations started in Queensland which has arguably the toughest engineering and safety standards in Australia. This experience has informed our methodologies and the important points of this paper detail for both owner and regulator, what to expect from the operator and what the operator will need to demonstrate compliance with. Hydrogen operations traditionally were on oil refineries which may have been in local communities, unlike remote upstream gas and oil projects far from the major populations. Refineries are typically close to transportation hubs and end users. Our experience is that hydrogen or hydrogen transport fluids such as ammonia, methylcyclohexane (MCH) and others are more likely to reside near major international ports with close access to both clean energy and available workforce which heightens the environmental, social, governance and community risk management requirements. This paper intends to inform regulators, owners and operators of the unique challenges and aspects of getting a hydrogen facility up and running in a safe and community sensitive way.

## Introduction

This paper discusses the challenges and aspects of transitioning a hydrogen facility from construction to operating in a safe and community sensitive manner. GR Production Services (GRPS) were engaged by ENEOS Corporation to operate and maintain their Green Hydrogen Pilot Plant at Bulwer Island, Brisbane in 2023. The project used world first Direct MCH® technology developed by ENEOS Corporation, Chiyoda Corporation and Queensland University of Technology to produce green hydrogen (methylcyclohexane – MCH).

MCH is a liquid at normal temperature and can be transported in a similar way to oil so has the potential to significantly reduce costs associated with the production of CO<sub>2</sub>- free hydrogen (ENEOS 2021).

With client stakeholder expectation to rapidly transition from construction to production, four key initiatives were implemented to enable a safety culture that delivered safe commissioning and incident free operations:

1. Detailed Operational Readiness and Assurance Register to track and confirm close-out of actions prior to commencing respective phases leading to production operations.
2. Gated Pre-Startup Safety Review process to formally confirm operational readiness.

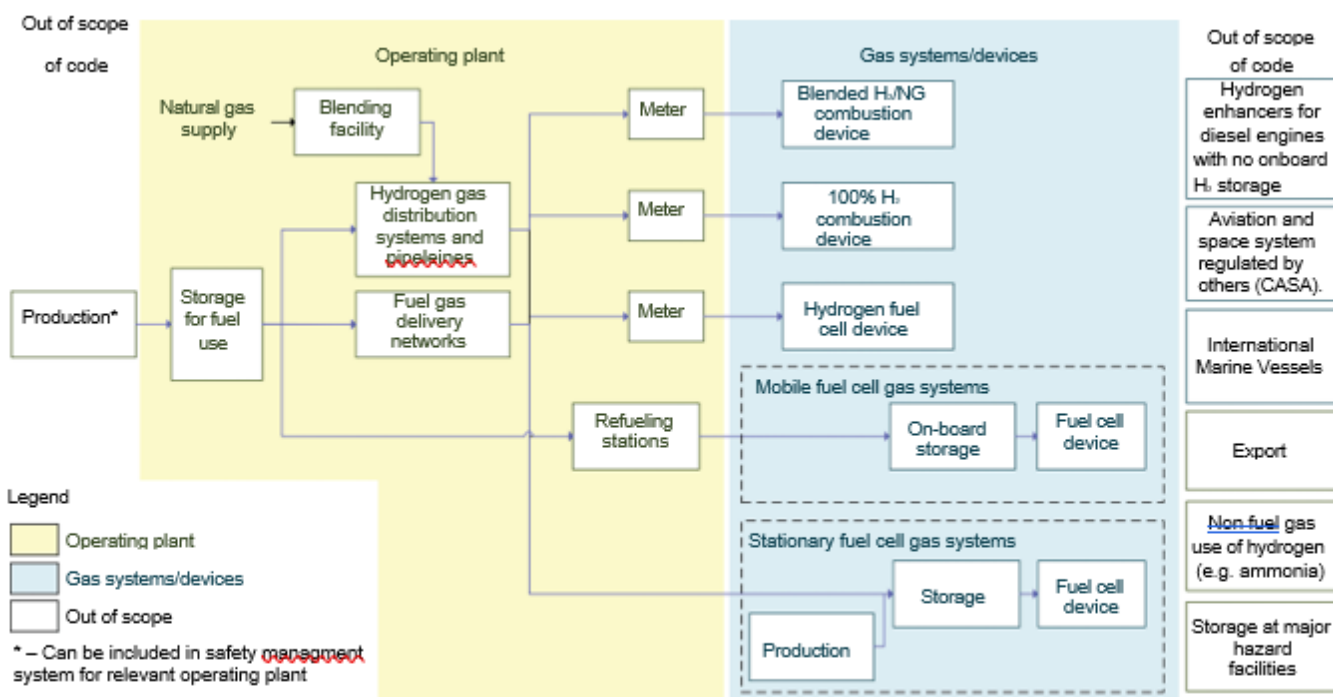
3. Consultation and training for frontline workers in developing safe operating procedures using Usability Mapping.
4. Methodical risk assessments completed by the operations team to review associated risks and controls prior to each new activity being performed.

**The hydrogen regulatory regime in Queensland**

The Queensland state government appointed Australia’s first dedicated minister for hydrogen in 2020 with Hon Mick de Brenni MP appointed as the new minister for energy, renewables and hydrogen. It was the first appointment of an Australian minister dedicated to hydrogen, providing an indication of the key role the Queensland government expected hydrogen to play in both the local economy and as a major new export opportunity for the state.

In Queensland, safety and health are regulated by government agencies including the Petroleum and Gas Inspectorate of Resources Safety and Health Queensland (RSHQ), Workplace Health and Safety Queensland (WHSQ) (Office of Industrial Relations) and the Electrical Safety Office (Office of Industrial Relations) (Queensland Government).

In Queensland, the safety of fuel gases, including hydro- gen, is regulated under the Petroleum and Gas (Production and Safety) Act 2004 (P&G Act) which is administered by the Petroleum and Gas Inspectorate of Resources Safety and Health Queensland (RSHQ) (RSHQ 2023). However, as outlined in Fig. 1 below, hydrogen production is currently excluded from the Hydrogen Safety Code of Practice. Consultation with the Petroleum and Gas Inspectorate con- firmed they would not classify the production of MCH as a hydrogen project and therefore WHSQ was the primary safety regulator.



**Fig.1.** Scope of common operating plant and gas devices related to hydrogen in Queensland.

As the chemical inventory of Schedule 15 chemicals for the Green Hydrogen Pilot Facility were below the thresholds for a Major Hazard Facility, the WHSQ Hazardous Chemicals Unit was the key safety regulator. GRPS consulted with all three regulators as the hydrogen regulatory environment is subject to change and the next phases of the Green Hydrogen Project Facilities will be larger with greater chemical inventories.

### **Operational readiness**

A detailed Operational Readiness and Assurance Register (ORAR) was developed to systematically track, verify and close-out over 300 actions identified prior to operations commencing. Weekly meetings were held with the project team to review the ORAR, ensure effective communication and consultation and manage project milestone timeframe expectations with all stakeholders.

A gated Pre-Startup Safety Review process was implemented to confirm operational readiness across five key project milestones:

1. Site control (GRPS controlling the site with the construction team still present).
2. Hazardous chemicals storage (residual construction team onsite with step-change in risk due to the presence of hazardous chemicals).
3. Chemicals in plant commissioning (large step-change in risk profile leading to the introduction of the chemical production process).
4. Rectifiers and electrolyser commissioning (additional risks and hazards to be managed including electromagnetic fields).
5. Production operations.

### **Usability mapping SOPs**

The GRPS operations team were provided with translated operations documentation from the Client Research and Development team. The operations team needed to get up to speed quickly to develop the operational readiness deliverables, be trained in the project specific risks and hazards, and assess and confirm readiness for safe commissioning and operations of the pilot facility.

The operations team needed to develop safe operating procedures (SOPs) from Japanese operations documentation provided by the Research and Development team. The client and operations team were consulted and shown the benefits of developing SOPs using Usability Mapping.

Usability Mapping is a methodology to engineer documents that drive user behaviours safely and reliably, drawing on psychology and neuroscience. Usability Mapping reduces clutter and improves readability and usability of safety critical documents (Hofer 2020).

All parties agreed to Usability Map all SOPs for the project, with the operations team provided a template and training. This resulted in operator team engagement, ownership and understanding of the SOPs for the facility production operations phase. The client, including their refinery department senior process safety representatives were impressed with the approach used to Usability Map SOPs and engaged GRPS to implement this new best practice for the commissioning process, which the client was managing.

### **Summary and conclusion**

Critical success factors were thorough operational readiness preparations, and consultation and engagement with the frontline workforce exposed to hazards and risks. This greatly contributed to the development of a strong safety culture, particularly given all operations team members had been recruited from a range of different industries, to best prepare for the demonstration facility's combination of technologies and production products.

In particular, enabling frontline workforce involvement in the development of the SOPs resulted in proactive operations team engagement, ownership and a detailed understanding of the management system used onsite, to ensure effective risk management, leading to incident free commissioning and production operations.

### References

ENEOS (2021) ENEOS, Chiyoda, and QUT Successfully Scaled Up an Australian CO<sub>2</sub>-Free Hydrogen Supply Chain Demonstration using Direct MCH® ~Filling a FCV with hydrogen derived from renewable energy~. [Press release] Available at [https://www.eneos.co.jp/english/newsrelease/2021/pdf/20211102\\_01.pdf](https://www.eneos.co.jp/english/newsrelease/2021/pdf/20211102_01.pdf)

Hofer K (2020) 'Document Usability. In AIHS, The Core Body of Knowledge for Generalist OHS Professionals', 2nd edn. (Australian Institute of Health & Safety: Tullamarine, Vic.) Available at <https://www.business.qld.gov.au/industries/mining-energy-water/resources/safety-health/petroleum-gas/safety-news-education/hydrogen>

RSHQ (2023) Hydrogen Safety Code of Practice V.1.0. (Resources Safety & Health Queensland). Available at [https://www.rshq.qld.gov.au/\\_\\_data/assets/pdf\\_file/0003/1746453/Hydrogen-Safety-Code-of-Practice.pdf](https://www.rshq.qld.gov.au/__data/assets/pdf_file/0003/1746453/Hydrogen-Safety-Code-of-Practice.pdf)

### The author



Greg Chrisfield (FAIHS, ChOHSP) is the National HSSEQ Manager at GR Production Services. Greg is a Fellow of the Australian Institute of Health and Safety, a Certified Chartered Generalist OHS Professional and holds qualifications in Workplace Health and Safety, Occupational Hazard Management, Innovation and Service Management.

Accomplished in health, safety, security, environment, community, risk, quality and sustainability, Greg has over 30 years of senior HSSEQ leadership experience (locally and internationally) in high-risk Energy, Oil and Gas, Utility, EPCM and Asset Management industries at previous roles including QGC, Buru Energy, Oil Search, Ausenco, Morris Corporation, TXU and United Nations. As the National HSSEQ Manager, Greg sets the strategy for the GRPS HSSEQ department ensuring company KPIs and goals are achieved. He and his team monitor compliance with internal and external requirements, auditing across the business and the provision of resources to ensure the ISO certification is maintained while supporting regional operations.