AFAC Emergency Responders Training Analysis

A report for the National Hydrogen Strategy

Final Report
September 2021

Australasian Fire and Emergency Service Authorities Council Limited (ABN 52 060 049 327)

Level 1, 340 Albert Street
East Melbourne Victoria 3002

Telephone: 03 9419 2388
Facsimile: 03 9419 2389

afac@afac.com.au
afac.com.au

Disclaimer

AFAC advises that the information contained in this report comprises statements based on the research and findings of the project team. Workshops with AFAC Stakeholders, interviews with academia and industry bodies have contributed to the information and findings contained in this report.

Report title:

National Hydrogen Strategy

AFAC Emergency Responders Training Analysis

Authors:

Project Team

Trent Brown- Acting Superintendent, Fire and Rescue NSW (New South Wales)

Kerrie Kent- Senior Project Officer, Fire and Rescue NSW

Acknowledgements

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Introduction

About this report

The National Hydrogen Strategy – AFAC Emergency Responders Training Analysis is intended to assess the training needs of Australian fire and emergency service workers (not including Ambulance and Police) in managing the emergency response to incidents involving hydrogen as new applications are introduced in Australia. The aim of the analysis is to provide insight into the development requirements of a nationally consistent approach to hydrogen safety training, and to set out a framework for addressing new training needs as hydrogen applications emerge and scale.

This report is for the Australian Government Department of Industry, Science, Energy and Resources (DISER), South Australian Government and AFAC member agencies. It provides vision for Australian emergency responders and the essential principles of effective emergency management being prevention, preparedness, response, and recovery and how they will be developed for the emerging hydrogen industry within Australia.

This training analysis commenced in April 2021. It is considered the first phase of a wider body of work to address Australia's National Hydrogen Strategy 2019, Section 5.8

This report was prepared by the National Hydrogen Strategy – AFAC Training Needs Analysis Project Team, Fire and Rescue NSW (FRNSW) Acting Superintendent Trent Brown, HAZMAT and Counter Terrorism and FRNSW Senior Project Officer Kerrie Kent, Strategic Capability.

The project team has made a commitment to provide the information as relayed to them, and develop findings based on the input of stakeholders through engagement workshops, and information received from the identified stakeholders.

Background

Australia's National Hydrogen Strategy[1]

In 2019, the Council of Australian Governments (COAG) released Australia's National Hydrogen Strategy. (The Strategy)

The Strategy sets a vision for a clean, innovative, safe, and competitive hydrogen industry that benefits all Australians. It aims to position Australian industry as a major global player by 2030.

The hydrogen strategy:

- explores Australia's clean hydrogen potential
- considers future scenarios with wide ranging growth possibilities
- outlines an adaptive approach that equips Australia to scale up quickly
- includes showcases from each state and territory
- details nationally coordinated actions involving governments, industry, and communities.

The Strategy looks to initially concentrate hydrogen use in niche hubs that will foster domestic demand. A strong domestic hydrogen sector will underpin Australia's exporting capabilities, allowing the nation to become a leading global hydrogen player.

The Australian Government has already committed more than $1 billion in support for the hydrogen industry. These projects will help stakeholders learn more about how hydrogen can form part of Australia's energy mix to help drive down prices and emissions, as well as provide a foundation of expertise to build a competitive export industry.

Every state and territory in Australia have regions with excellent prospects for hydrogen production. Through the Strategy, all of Australia's governments are committing to remove barriers to industry development. This includes nationally consistent and smart regulation, enhanced engagement with customer countries, and in ensuring safety concerns are addressed.

Actions outlined in the Strategy are themed around national coordination, developing production capacity and local demand, responsive regulation, international engagement, innovation and research and development (R&D), skills and workforce, and

1 Australia's National Hydrogen Strategy. *Section 5.8 - Training for Australian Emergency Services* provides the impetus for the AFAC Emergency Responders Training Analysis project. Hydrogen training for Australian emergency services is critical to maintain a safe environment for the community, emergency services and industry. Appropriate training for emergency services on how to deal with a hydrogen-related incident is essential to minimise the risk to themselves, others, property and equipment.

community confidence. The actions consider hydrogen in relation to exports, transport, industrial use, gas networks, electricity systems, and cross-cutting issues such as safety, skills, and environmental impacts.

New jobs and growth of clean hydrogen will endeavour to be achieved without compromising safety, cost of living, water availability, access to land or environmental sustainability. Governments and industry have the responsibility to ensure community safety, confidence, and trust in the new industry, and deliver benefits for all Australians.

Hydrogen capability for emergency response

Australia's National Hydrogen Strategy 2019, Section 5, *Building benefits for the Australian community,* concentrates on the actions governments will take to ensure community concerns are addressed and trust in the hydrogen industry is nurtured. The government has committed to considering societal expectations, raising public awareness, ensuring factual information and providing a robust regime for safety standards.

This project has undertaken a deep dive into the training needs of AFAC member agencies. It has reviewed hydrogen training materials and international best practice models currently available to Australia from the United States of America and Europe.

This report will discuss the value of emergency services having consistent and accessible training materials and guidelines for managing hydrogen related emergencies, as well as the benefits and constraints that may occur by embedding hydrogen training into the Public Safety Training Package.

Stakeholder Consultation

Extensive stakeholder engagement was crucial to discovering the training needs of AFAC member agencies. The project team consulted with:

- AFAC member agencies
- External stakeholders
  - Universities – University of Queensland, Deakin University, Ulster University
  - American Institute of Chemical Engineers (AIChE)
  - Fuel Cell Hydrogen Joint Undertaking (FCHJU)
  - National School Supérieure Des Officiers De Sapeurs-Pompiers (ENSOSP) – France
- Industry regulators

AFAC member agencies were first surveyed in May 2021 to ascertain each agencies' capability composition and potential need for training. In late May and June 2021, AFAC member agencies were invited to participate in state-based workshops. The stakeholder workshops were designed to capture data the project team required to undertake the training needs analysis and represent the priorities of emergency services personnel.

An external environmental scan on available training content, industry participation and potential needs of regulatory bodies was undertaken, with both external and regulatory stakeholder engagement ongoing throughout the project. The information received informs the findings in this report.

AFAC member agency needs

AFAC agency members were overwhelmingly supportive of implementing nationally consistent hydrogen training materials with flexibility to tailor the content to suit local hydrogen risk landscapes.

AFAC member agencies requested baseline hydrogen awareness training for approximately 100,000 emergency responders. The cohort requested training content should be structured in levels and tailored to the existing knowledge base and technical capability of both the responder and the agency's hydrogen risk profile. Increased levels of incident complexity and risk may require multi-faceted, higher level technical capability.

Agencies requested the ability to have input into the development of training packages, and this has been reflected in the recommendations.

AFAC member agencies were collectively concerned with the impact implementation of hydrogen training will have on resources, both at implementation stage and in maintaining skills longer term. All the AFAC cohort indicated funding the development of training material or implementation of new hydrogen training package would create budget stress, with agencies balancing finite funding and competing pressures. However, full support was given to external development and funding for Hydrogen training materials and resources.

The inclusion of hydrogen specific training in the Public Safety Training Packages (PSTP) was not supported by the cohort; it was deemed to be restrictive and unsustainable.

The inclusion of hydrogen specific content in the PSTP presented the following challenges and limitations:

- Staff and members having already achieved a unit of competency (UoC) delivered under the PSTP have no requirement to undertake the module again. i.e. A large proportion of member agencies staff would not undertake the hydrogen training as the UoC has already been awarded.
- Which UoC within the PSTP would the content be included in? Member agencies do not deliver or undertake the same units within the PSTP.
- PSTP requires a high level of compliance and presents a barrier to rapid deployment of training content.
- It was commonly stated that learning content within a UoC is often focused on the prescriptive detail required to meet the UoC rather than the desired learning outcome or skill.
- UoC that currently focus on Hazardous Materials response and management principles utilise broad performance criteria to meet the unit of competency requirements and therefore may not meet the required training level desired for this project.

Training framework options and funding

AFAC member agencies were overwhelming supportive of a layered approach to hydrogen training and the development of a hydrogen training framework.

The project team reviewed the training packages available from two internationally recognised providers, being the Centre for Hydrogen Safety (CHS) at the American Institute of Chemical engineers (AiChE) in the US, and the Fuel Cell and Hydrogen Joint Undertaking (FCH JU) in the European Union (EU). Developed training content would meet the needs of Australian emergency services, however referencing of content to ensure compliance with Australian legislation, regulations, standards, and vocational training requirements will be required to ensure each agency satisfies their obligations as a Registered Training Organisation (RTO). Monitoring of content may be required to ensure relevance with the rapidly evolving hydrogen landscape.

Research has identified that a hydrogen awareness (baseline) E-Learning package is required for all emergency responders, and the content is readily available at a reasonable cost. Training at higher levels of complexity is needed for specialist responders. There is specialist content available from both the US and European networks, however it may require developing into modularised training packages for ease of use and tailoring by Australian emergency services.

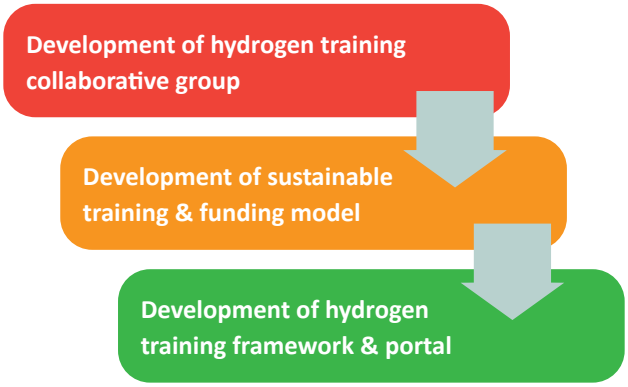
Funding models and budget limitations were explored with AFAC member agencies. All agencies were supportive of externally funded training development, with a variety of funding models identified. Government, industry, and academic partnerships were favoured.

Recommendations

The Australian emergency services community spans across 8 states and territories with fire, rescue, hazmat, humanitarian, natural disaster, judicial and medical response agencies all working under varying frameworks with overlapping response requirements. This community encompasses more than 100,000 emergency response employees and volunteers. The environmental scan of the developing Australian hydrogen industry indicates that it is quite possible for any of these responders to, at some point, have an interface with a hydrogen related emergency.

The recommendations below, and further detailed in the body of this report, have evolved from research undertaken, engagement with key stakeholders, and subsequent findings which are outlined throughout the body of this report and appendices. Adoption of the recommendations will provide a fit for purpose and sustainable hydrogen training framework that ensures the safety of emergency responders and keeps pace as the hydrogen industry matures within Australia.

The project team recommends the following three actions to support the implementation of hydrogen training for emergency responders in Australia:



Development of a hydrogen training collaborative group

To ensure efficacy of training requirements in providing a safe response to hydrogen related emergencies, a collaborative approach should be considered when developing, reviewing, and implementing training resources. It is recommended that representatives from emergency service agencies, industry and academia form a collaborative group to address the needs of emergency responders. All three areas will be critical to leveraging the knowledge of the collective to develop hydrogen training materials that keep pace with an evolving industry and are robust and sustainable.

Note: Established AFAC frameworks that incorporate representatives from industry and academia may provide a suitable alternative.

Development of a sustainable training and funding model

Emergency services hydrogen training needs to keep pace with the maturation of the Australian hydrogen industry. Development of a funding model to support this sustainable approach requires a commitment to year-on-year funding, with an expectation that the hydrogen market and end user applications may not reach clarity and a level of maturity until 2030.

Financial support, in addition to current funding, would be required to meet the preparedness commitments identified within this report. The expansion of response requirements attributed to the adoption of hydrogen applications will add pressure to finite resources within the emergency services community. Through the National Hydrogen Strategy 2019, the Australian Government has positioned policy and financial support mechanisms to support development within the hydrogen industry sector. It is recommended the Commonwealth government provide financial support to emergency services at pace with its investment in research and industry initiatives as it seeks to achieve greenhouse reduction targets.

Development of a hydrogen training framework and open-sourced portal

Development of an open-sourced training portal providing peer reviewed, on-going, and sustainable training resources will deliver the training needs of Australian emergency services as the hydrogen industry develops.

A mandated national training program, with limited or no flexibility in content, may not be achievable or required given the varying needs of the emergency responder communities. Alternatively, the development of a nationally consistent framework and repository of information, aligned to agency training specificities, will provide a platform where each service can access nationally consistent material and training resources that can be structured to their organisational needs.

Development of the open-sourced model will also provide training content and support to stakeholders not defined within the parameters of this project. Most agencies indicated that provision of ready-made content that could be delivered as is, or tailored to meet their jurisdictional needs, would be highly desired by their respective agencies.

National Hydrogen Strategy AFAC Emergency Responders Training Analysis

Project methodology

Project team

A dedicated project team, consisting of a project manager with hazmat training specialisation and a senior project officer with operational understanding, was formed to develop and implement a project plan, undertake research, engage stakeholders, review existing global hydrogen training materials, review findings, and develop recommendations.

Throughout the project, stakeholders and subject matter experts (SMEs) were invited to provide input and advice to the core project team.

Project objectives

The objective of this analysis was to undertake an initial scoping of the training needs of Australian fire and emergency service workers (not including Ambulance and Police) in managing the emergency response to incidents involving hydrogen, as new applications are introduced in Australia.

Project activities

- Research the hydrogen landscape within Australia
- Extensive engagement of AFAC member agencies through national workshops
- Extensive engagement with external stakeholders
- Review of existing training packages and training pathways.

Project outputs

Project outputs are a series of reports responding to the Statement of Requirement developed by the Commonwealth Government.

Outputs from this analysis will inform future bodies of work and contribute to achieving a national hydrogen training framework.

Potential project outcomes

Australian emergency services and first responders will have access to a nationally consistent training framework appropriate to their level of expertise. This training will prepare them to apply best practice emergency management strategies to hydrogen related incidents.

Potential benefits

The research undertaken by this project will contribute to achieving the relevant actions agreed in the National Hydrogen Strategy (the Strategy), which was released in November 2019 by the Council of Australian Governments (COAG) Energy Council.

The Strategy recognises the importance of a suitably trained emergency response force as an essential component of a viable, safe hydrogen industry that is backed by community support.

Access to nationally consistent hydrogen safety training materials, that is sustainable and scalable for emergency responders is another potential benefit dependent on future funding streams.

Hydrogen

The Australian Government is committed to increasing the use of hydrogen as a fuel source by the year 2030. The growth of the hydrogen industry will have implications in relation to the emergency management of hydrogen related incidents. AFAC member agencies will need a degree of training to understand the fuel source, know how it behaves in an emergency, and how they can best manage hydrogen related emergencies and render the scene safe.

Hydrogen as a fuel source[2]

Hydrogen is a flexible energy carrier that can be produced from several types of energy source and offers many opportunities for long-term energy storage. Hydrogen can be compressed, liquefied, and stored in a solid or liquid form for use in fuel cells, turbines, or internal combustion engines.

Hydrogen is a colourless, odorless gas with the lowest density of all gases. It is the most abundant element in the universe, found in the greatest quantities in water, and much smaller amounts in the atmosphere.

There are three methods of extracting hydrogen from water:

- Gasification- using coal
- Steam methane reforming – using natural gas
- Electrolysis- using electricity.

If a renewable electricity source (such as solar) is used, electrolysis has the potential to produce hydrogen with no carbon emissions. This can be referred to as green or renewable hydrogen.

Hydrogen as a fuel source is versatile. Technologies are available to enable hydrogen to be produced, stored, transported, and used as energy.

Hydrogen can be transported through pipelines in a gas or liquid form, much like liquefied natural gas (LNG).

It can be transformed into electricity and methane to power homes and feed industry, and into fuels for cars, trucks, ships, and planes.

Hydrogen as an energy carrier, has two outstanding properties. It has an extremely high energy density, and it can be released either as heat through combustion, or as electricity using fuel cells.

The only other input needed to release this energy is oxygen and the only emission is water.

This lack of greenhouse gas emissions means that it is a clean fuel with the potential to decarbonise many industrial sectors.

2 Hydrogen: the new Australian manufacturing export industry and the implications for the National Electricity Market (NEM) | AEMC

Hydrogen applications[3]

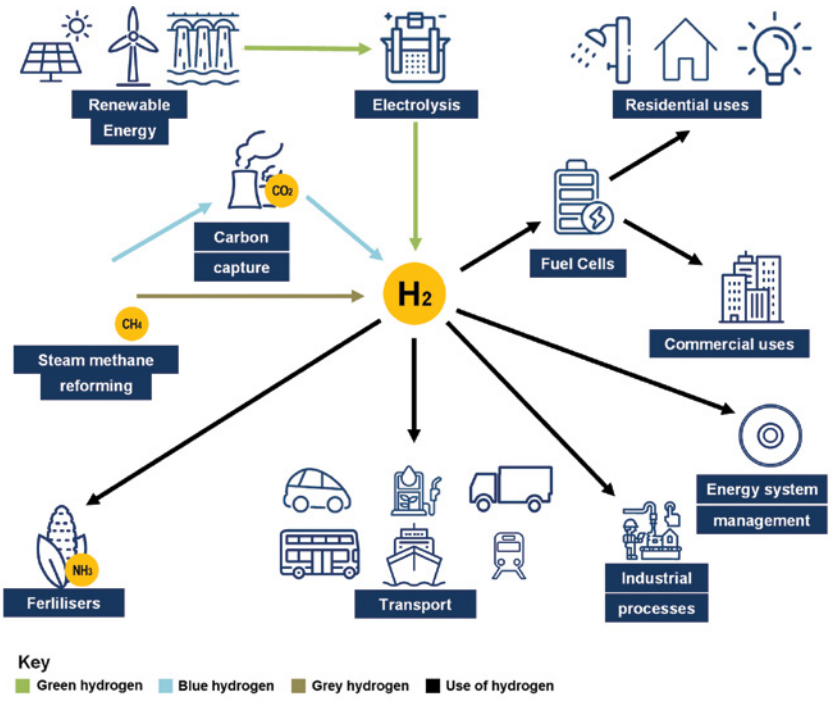
Hydrogen is seen as the clean fuel of the future, generated from water, and returning to water when it is oxidised.

Hydrogen use at the moment is predominately by industry; common industrial uses include:

- Oil refining
- Ammonia production
- Methanol production
- Steel production

Most of the hydrogen supplied for the above listed applications is generated using fossil fuels. As the push toward greener energy sources grows, there is significant potential for emission reduction using clean (green) hydrogen generated from sources such as solar and wind.

The future hydrogen landscape will see the increase of hydrogen as a fuel source for both industrial and domestic use as demonstrated in the graphic[4] below. Australian states are steadily increasing support and exploring opportunities for hydrogen projects, both in the domestic and export markets. The growth of the hydrogen market in Australia presents challenges for emergency responders across all current response capabilities.



3 AEMC- Hydrogen Australian manufacturing and market implications

4 CMS - Expert guide to hydrogen

Hydrogen landscape in Australia

The release of Australia's National Hydrogen Strategy (The Strategy) in 2019 outlines the Commonwealth government's intent to support the growth of hydrogen as a fuel alternative. This will decarbonise our energy, transport, and industrial sectors, achieve carbon reduction targets, and solidify Australia's position in the global hydrogen industry by 2030.

Australia's environment, established infrastructure, manufacturing capabilities and renewable energy potential sees Australia well-positioned to benefit from the global transition to a low-emission energy future. Proximity to Asia provides substantial opportunity for Australia to leverage our existing LNG expertise to take advantage of ambitious carbon reduction commitments made by Japan and the Republic of Korea.

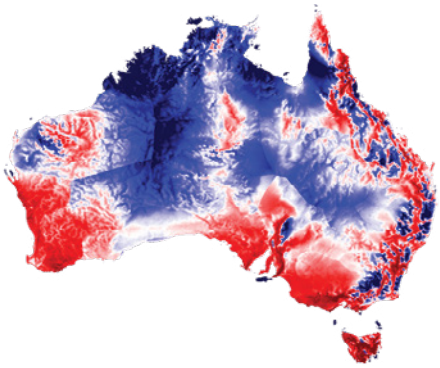
Australia's National Hydrogen Strategy, estimates an Australian hydrogen industry could generate about 7,600 jobs and $11 billion in GDP in 2050 with targeted global deployment; if global markets develop faster, consistent with the energy of the future scenario, estimates rise to around 17,000 jobs and $26 billion in GDP.

In September of this year, the Commonwealth government launched the $464 million grant program for clean hydrogen industrial hubs. This is in addition to the $566 million for strategic international partnerships on low-emissions technologies and the $263.7 million carbon capture and storage (CCS) projects announced in the 2021-22 budget.

Australian industry, academia and governments are active in working together to develop hydrogen as a viable clean fuel alternative, and will provide support to develop technology, infrastructure, and policy, enabling a full supply chain hydrogen market. The Strategy identifies that a commitment to the use of hydrogen as a fuel source is a long-term commitment. With rapidly evolving technology and changing trajectory, the participants in the development of the hydrogen market will take a sustained approach to funding and resourcing in an attempt to achieve carbon reduction emissions by 2030.

As the market develops, there is a level of uncertainty as to what the Australian hydrogen landscape will look like in the future. This presents a significant challenge for the development of Australian emergency service hydrogen training programs. Early engagement with emergency services presents an opportunity for all AFAC member agencies to play an active role in the development of a viable Australian hydrogen economy. Active participation in the development of technology and policy as the hydrogen economy evolves, will ensure emergency services are well equipped to manage response to emergencies that may arise as the technology becomes more common.

The image[5] below demonstrates the regions across Australia where hydrogen production is likely to be economically viable. Stakeholder workshops have indicated the current hydrogen landscape across Australia is at varied stages of maturity, with some states leading from the front and others yet to have any significant development. The AFAC Response to the Statement of Requirement (Appendix B) outlines in detail the projects underway in each of the states.



Economically favourable locations (in red) with hydrogen produced by wind

5 CSIRO HyResource Mapping

Emergency services - hydrogen capability

With the introduction of hydrogen infrastructure and end user applications into the Australian market, AFAC member agencies will see the growth of a new response hazard. While some agencies have an existing general capability to detect and respond to dangerous flammable gases such as hydrogen, as the use of hydrogen expands across Australia, AFAC agencies that did not previously deal with this type of hazard may be required to respond to such incidents. Stakeholder engagement workshops revealed that these agencies did not have sufficient existing capability and equipment to respond to these incidents.

What is capability?[6]

Definition

Capability, in the context of this training needs analysis, is defined as:

- The ability to deliver a service within a specified time and sustain that service delivery for the time required.

Capability has three components:

- Inputs to capability – people, organisation, information, support and facilities, training, equipment, and doctrine (known as POISTED)
- Readiness – the ability to apply capability within a specific time
- Sustainability – the ability to continue the application of capability for the required time.

Capability

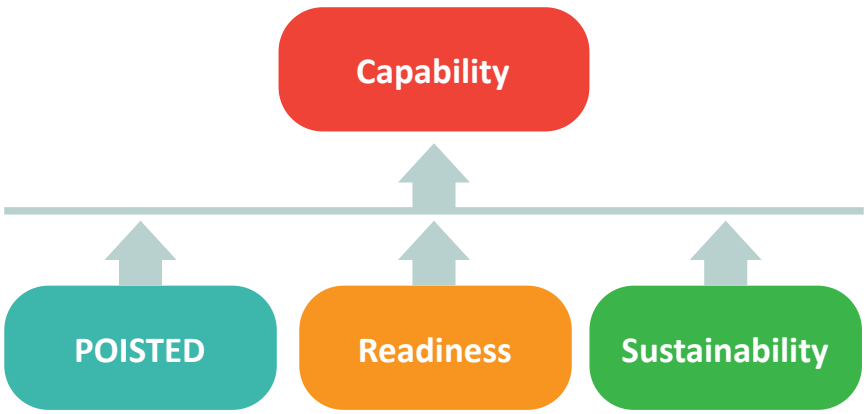
Capability is not the sum of the POISTED inputs, but rather is the synergy that arises when those inputs are combined. The inputs are mutually interdependent and cannot be considered in isolation.

Readiness

Readiness is how long it takes an agency to deploy a capability. Most emergency services are ready to respond 24 hours a day, 7 days a week. Other specialist services take longer to deploy, for example, a specialist hazmat response.

Sustainability

Sustainability is how long an agency can continue to provide a capability to a particular incident, and how many simultaneous incidents they can respond to without loss of capability.



6 FRNSW Operational Capability Framework – Policy no GC01-007 Version 01 May 2016

POISTED - Inputs to capability

Capability results from the combination of a variety of inputs. The creation, evolution or termination of a capability is only possible through adjusting the POISTED[7] inputs for that capability.

The AFAC Emergency Responders Training Analysis focuses on the POISTED elements **Training and Doctrine.**

POISTED inputs must be tightly integrated and managed holistically, within a defined budget, to establish and maintain a capability. A deficiency in any one input adversely impacts the whole.

It is important to note that the Australian Government and AFAC member agencies will need to consider the impacts of all POISTED elements to provide a hydrogen response capability. Provision of training materials alone will not be sufficient for all AFAC agencies to have a response capability. Stakeholder workshops have highlighted the cohort will have additional needs for equipment, personnel, information, and organisation support.

7 POISTED is derived from an Australian Army model known as POSTED. The I was inserted by FRNSW to include the information and communications technology context. The Australian Defence Force no longer uses POSTED; however, the model is relevant to an Emergency Services provision of a capability.

People

The people input incorporates recruiting, developing, and retaining the necessary personnel with appropriate skills to deliver, manage and support the capability.

The people part of POISTED also incorporates all conditions of service and employment, including entitlements, salaries and allowances, superannuation, and the wider industrial framework.

Organisation

The organisation input seeks to ensure that AFAC member agencies have the optimum organisation structure, command structure, resource allocation, governance frameworks and external partnerships to deliver the capability.

Organisation includes both the organisation structure, which supports the day-to-day management, and the incident management system, which describes how an agency organises itself at incidents.

Information

The information input relates to data, information and the related technology required to deliver services.

Support and facilities

The support and facilities input covers the infrastructure and support required to deliver services. It encompasses services provided both in-house and by external service providers, including partnerships with other agencies.

It includes:

- infrastructure, including properties, plant, and facilities
- procurement and supply services
- asset management services
- maintenance services
- transport of equipment and personnel
- administrative and corporate services.

Training

The training input seeks to ensure that each person has the appropriate training to perform the functions of their position and that their skills and competencies are maintained to an acceptable level over time.

Training is a key element in the delivery of capability. Changes to capability require changes to training that might, in turn, impact on personnel, organisation, information, equipment and doctrine. The training input includes not only training programs, materials, and resources, but also the people, facilities and resources required to develop, deliver, assess, and review the training.

Doctrine

The doctrine input includes the policies, procedures, training resources, technical documentation, and other information required to effectively deliver a capability.

Doctrine helps standardise operations so that services are delivered to the community effectively and safely.

It is the foundation of training and connects what is taught to what an agency does. New capability usually requires new doctrine, and even slight changes to capability may require doctrine to be reviewed. The cost and effort of changing doctrine needs to be included in capability planning.

Equipment

The equipment input covers fleet, general and specialised equipment, uniforms, and personal protective clothing. Implementing a new or changed capability requires not only the acquisition and implementation of the initial equipment needs, but consideration of the whole life cycle of the equipment to ensure the capability can be maintained. It also needs to be recognised that acquiring equipment is not sufficient to deliver a capability – people, organisation, information, support, training, and doctrine are also required.

AFAC member agency needs

Research undertaken identifies the emerging nature of the hydrogen application landscape. Training packages delivered will need to be fluid and scalable, capable of keeping pace with the rate of a swift moving and constantly evolving hydrogen industry.

Extensive stakeholder consultation was undertaken to afford all AFAC agency members an opportunity to gain oversight of the project, provide input, and contribute to analysing training needs for their specific jurisdictions. During the workshops, needs not within the scope of this project, such as equipment and doctrine, were also acknowledged as they will impact on an agency's response capability.

Segmented training

AFAC agency members were overwhelmingly supportive of implementing nationally consistent hydrogen training packages that provide flexibility to tailor the content to suit local landscapes. The cohort requested hydrogen training content for emergency responders be structured or segmented into scalable modules. Each module should align with the existing knowledge base and technical capability of the responder, and to the local hydrogen risk profile. Increased levels of incident complexity and risk may require multi-faceted and/or higher levels of technical capability. The AFAC Response to the Statement of Requirement (Appendix B) outlines all proposed segments of training in detail.

AFAC member agencies highlighted a need for a timely hydrogen training roll out in relation to their individual hydrogen risk profile.

Proposed training segments include:

- Hydrogen awareness
- Specialist responders
- Train the trainer.

Hydrogen awareness

Hydrogen fundamentals is to be considered the base line educational requirement for emergency responders as the hydrogen energy supply industry and subsequent end user applications increase in the Australian industrial and domestic landscape.

A base level awareness will be the foundation on which all training enhancement programs should be built, with the base level becoming a pre-requisite for more advanced content. When researching international best practice in the delivery of hydrogen training, the project team determined a stepped or scaled delivery structure proved to be successful.

The AFAC cohort identified that approximately 100,000 emergency responders would require training at the awareness level. This includes all career, on-call, and volunteer emergency response personnel. A hydrogen awareness program is particularly critical in raising the knowledge base of less specialised responders that may not be exposed to hazardous materials incidents on a regular basis, particularly those responders in regional or remote areas where a specialist response may be delayed.

The minimum suggested content at this level should include:

- Physical and chemical property identification
- Industry and end user applications
- Incident response guidelines
- Preparedness

Specialist responders

Specialist rescue and hazmat responders theoretically possess a base level of knowledge about current alternate fuels and energy. Given the response profile of these groups, rescue and hazmat specialists will require detailed academic training in hydrogen response.

Specialist rescue response

Rescue trained personnel free victims of transport related crashes using a range of specialist hydraulic, air and electrically powered rescue equipment. The same equipment and techniques are also applied at incidents involving rail, bulk road transportation, domestic and other industrial rescue emergencies.

As hydrogen becomes more common as an alternative fuel source for passenger vehicles and is transported by road and rail to distribution points, rescue responders will need to enhance their ability to respond effectively to rescue incidents involving Hydrogen.

AFAC member agencies identified that approximately 25,000 rescue responders would require training at a specialist level.

Specialist rescue response training suggested content includes:

- Identification of hydrogen fuel cell vehicle (HFCV)
- Implications for road crash rescue response for HFCV
- Bulk transportation emergency response
- Fire protection measures
- Equipment required to detect hydrogen
- How to identify vehicles electrical system has been isolated
- How to identify fuel systems and the hazards they present to rescue operators
- Safety systems
- Risk mitigation strategies.

Response mechanisms in place within each jurisdiction provide management capability for possible Hydrogen related emergencies and will continue to support development of training and capability as industry and applications reach maturity within the Australian marketplace.

Photo credit: Fire and Rescue NSW

Specialist hazmat response

Hazardous materials response units have advanced capabilities in the detection of toxic industrial chemicals, volatile substances, and chemical warfare agents. Hazmat response personnel can deal with hazmat incidents ranging from small and contained, to large and complex.

Training for hazmat response staff across jurisdictions is professionally managed and uses standard methodology to respond to hazardous materials emergencies. Scientific Officers from various state jurisdictions develop and provide specialised training in response to all hazardous materials incidents.

Hazmat response personnel are trained to provide the following capability:

- Identify the hazardous material where possible.
- Effect rescue from a hazardous materials emergency.
- Provide specialist detection systems that can respond to hazardous material incidents.
- Provide evacuation modelling at an incident, to determine the consequences of an actual or impending hazmat on the community.
- Manage the hazardous material incident.
- Render the site safe.
- Provide technical advice and support to agencies for the safety of emergency workers at a hazardous materials emergency.

Response mechanisms in place within each jurisdiction provide management capability for possible Hydrogen related emergencies and will continue to support development of training and capability as industry and applications reach maturity within the Australian marketplace.

Photo credit: www.qfes.qld.gov.au

Train the trainer

The training input into a capability seeks to ensure that each person has the appropriate training to perform the functions of their position, and that their skills and competencies are maintained to an acceptable level over time.

Training the 'trainers' of each AFAC member agency will provide proper preparation for those personnel who, in time, become the specialist hydrogen training resource within their respective agency. The majority of AFAC member agencies are highly supportive of a train the trainer package to develop an Australian knowledge base and build a cost efficient, sustainable training model.

Equipment and doctrine

An agency's capability to respond to an incident has many inputs, and training is just one of those inputs. Exploring all capability inputs to enable and sustain an agency's ability to respond to a hydrogen incident is not within the scope of this project, however each capability input will have bearing on the preparedness for response.

Some of the AFAC cohort highlighted capability gaps in providing a hydrogen response, areas of concern raised were the provision of suitable hydrogen detection equipment and the development of doctrine to support a hydrogen capability.

Equipment

Stakeholder engagement workshops revealed some AFAC member agencies with volunteer workforces do not have the required equipment to respond to a hydrogen related incident, for example appropriate gas detectors and thermal imaging cameras. Due to the unique burn characteristics of hydrogen, this equipment would be considered a baseline resource for any crew responding to a potential hydrogen incident. Provision of this equipment would be a significant unfunded expense.

Several of the cohort felt there was a need for practical training props. There will be cost involved in purchasing and building hydrogen specific training props or retrofitting existing props for hydrogen fuel. There is, however, opportunity for resource sharing and interagency collaboration in the training landscape.

Doctrine

Doctrine includes the policies, procedures, training resources, technical documentation, and other information required to effectively deliver a capability. As outlined in the explanation of capability inputs (POISTED), a new capability such as hydrogen will require new doctrine, and even slight changes to a capability will require operational doctrine to be reviewed.

The development of training doctrine is within the scope of this project and will be considered and developed in future phases. The cost and effort of reviewing and changing existing operational doctrine to include a hydrogen capability was raised by AFAC member agencies.

Stakeholder consultation[8]

AFAC Member Agencies

Stakeholder engagement survey

Extensive stakeholder consultation was required to afford all AFAC agency members an opportunity to gain oversight of the project, provide input, and contribute to identifying training needs for their specific jurisdictions.

Data collection was gathered through stakeholder workshops undertaken during May and June 2021. On commencement of the project, contact was made with each AFAC member agency, and a survey distributed to gather preliminary information and training needs.

Stakeholder workshops

Throughout late May and into June 2021 the project team travelled to each state to conduct workshops with AFAC member agencies. Engagement with State Emergency Services (SES) has occurred to ensure sufficient input and multiplicity in the representation of emergency services. A standard presentation (Appendix D) and question set was developed to ensure consistency in the data set collected from all stakeholder sessions.

A standard question set was developed to ensure consistency of data collection. Throughout the course of the project, AFAC stakeholders have been contacted to provide clarity around their response or to provide insight into their individual risks and needs.

The data collected has been compiled and analysed by the project team to inform both this report and the AFAC Response to the Statement of Requirement. The analysis of training needs and other agency requirements has aided the development of recommendations to guide the future direction of the project in satisfying the objective of the National Hydrogen Strategy Section 5.8.

COVID-19 impacts across the country resulted in the Victorian workshop being held online. The absence of a face-to-face environment and the secondary conversations that flow in that medium did reduce the volume of information collected, but this did not impede the project or underrepresent the opinions of Victorian based agencies. Where required additional engagement occurred to substantiate or clarify data.

Stakeholder report socialisation

Additional stakeholder engagement sessions will be undertaken to socialise the findings of the training analysis. This will occur through an online forum due to the pandemic crisis across the country and border closures.

Spontaneous COVID-19 outbreaks and associated lockdowns across the country continue to obstruct the ability to travel freely, making additional face-to-face stakeholder engagement unlikely.

8 Detailed stakeholder engagement details are included in Appendix C

External Environmental Scan[9]

Subject matter experts

The project team have engaged with industry, government, and specialist training providers both nationally and internationally, undertaking an environmental scan to ascertain emerging industry developments, industry best practice and review training packages that may be suitable for emergency first responders.

Significant engagement with external stakeholders from industry, government, academia, and specialist training providers both nationally and internationally occurred during the project.

The project team consulted with expert academics from across Australia and Europe to determine the status of the hydrogen market in Australia and explore the potential for resource sharing and partnerships.

Sound working relationships have been forged with Deakin and Queensland Universities in Australia, Ulster University in the United Kingdom, the Centre for Hydrogen Safety in the USA, and the Fuel Cell and Hydrogen Joint Undertaking in Europe.

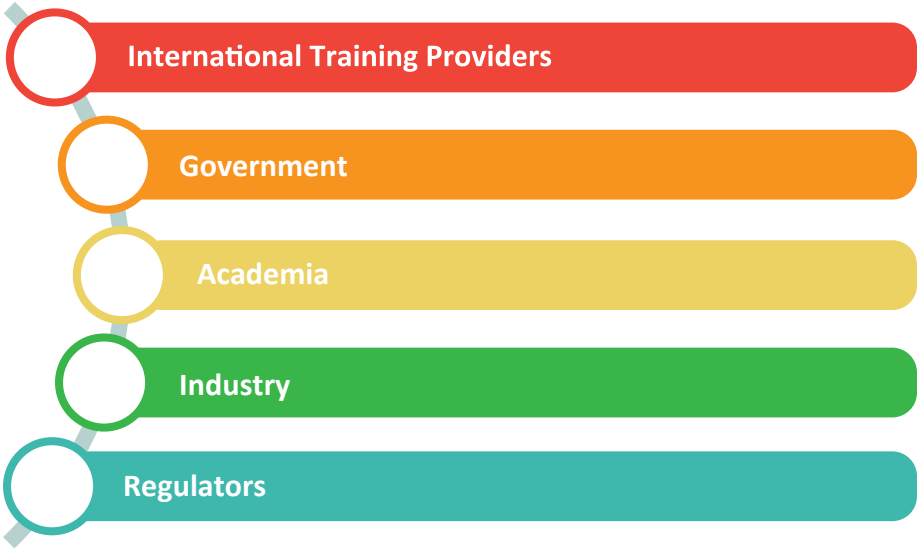
Establishing a shared community of purpose will facilitate access to expert opinion, training materials and international hydrogen experts from over 16 countries. Data and intelligence gathered was used to inform this report and will contribute to future phases of the project.

Regulators

The regulatory framework within Australia is comprehensive. National, state, territory, and local authorities all contribute to the regulation of multiple industries and practices; many of which may be impacted by the increase in the use of hydrogen as an emerging energy source and its predicted end user applications.

Regulators present a wide ranging and complicated framework that may require training to ensure preparedness as the hydrogen marketplace matures. The project team engaged with regulatory bodies throughout the course of this project to ascertain any potential training needs the collective may have.

In discussion with Safe Work NSW, Safe Work Australia and the NSW Environmental Protection Agency (EPA), it was a common thread that these bodies have mechanisms in place that would initiate an enhancement in training as new technologies or risks present themselves in the regulatory environment. The training and education sections within each regulator would seek guidance and support from industry or other government partners, such as emergency services, to develop fit for purpose training resources when addressing new or emerging trends. It was identified that the sharing of training material across government agencies is customary practice.



9 Detailed stakeholder engagement details are included in Appendix C

Options for a training framework

Structure of training

AFAC member agencies overwhelmingly supported a layered approach to the structure and delivery of any hydrogen training packages. All agencies indicated that an E-Learning package suitable for base level emergency responders be delivered as an initial hydrogen awareness program. This package would be developed in such a way that the content could be converted to text for those agencies that may have difficulty delivering the content via an online platform. The content would also need to be adaptable to enable a presenter to deliver the content as a group learning session.

Train the trainer sessions through a face-to-face deep dive model was highly supported for training teams that will be required to deliver ongoing programs.

90% of agencies supported more in-depth face-to-face training for specialist responders.

Layered training programs that are agile enough to scale to meet specific training needs according to the risk profile of each agency is highly supported.

Training content has been explored in depth in the AFAC Response to the Statement of Requirement (Appendix B). Granular detail of training content is not within the scope of this project: however, it should be developed in the future bodies of work.

Training content covering the topics below will meet the needs of the current hydrogen environment in Australia:

- Broad overview of hydrogen
- Fire, rescue, and hazmat specific topics

National consistency in training

A national training program may not be achievable or required given the varying needs of the emergency responder communities. However, consistency in training content and available materials is highly supported.

AFAC member agencies supported the development and adoption of a nationally consistent training program. A degree of flexibility to adapt the training to meet each agency's hydrogen landscape was preferred.

Inclusion of hydrogen training into the mandated Public Safety Training packages were broadly debated with mixed enthusiasm. Some agencies supported inclusion, others felt inclusion into a Public Safety Training package would create a level of complexity and demand on training resources that was unsustainable.

Development of an open-sourced portal or repository of nationally consistent training content, aligned to agency training specificities and regulatory guidelines, will provide a platform enabling each service to access nationally consistent material and develop training resources structured to their organisational needs.

Given the resource barriers identified through the stakeholder engagement process, development of an open-source collective of modulated content would address the need for flexibility and support requested by agencies.

Development of the open-sourced model will also provide training content and support to stakeholders not defined within the parameters of this project, such as secondary responders.

Alternate Training Approaches

Each AFAC member agency has a training framework that suits their individual jurisdiction. These frameworks will need to be considered in the adoption of any training packages.

Training packages will need to accommodate individual barriers such as:

- Training capability
- Participant numbers
- Tyranny of distance
- Vocational ability of the participant
- Industrial ramifications
- Existing learning management systems
- ICT barriers.

With these issues identified, the following alternate training approaches may be suitable for some, but not all AFAC member agencies. This may be explored in future phases of this project.

Alternate Training Approaches

- Virtual reality
- Upskilling current training teams to international best practice utilising established international training resources
- Instructor led online training
- Professional online conferencing facilitated by subject matter experts
- Practical training resource development
- Case studies
- Lessons learned
- Industry engagement to source potential training support
- Contract private industry to develop and provide training materials.

Analysis of current training packages

In the United States and Europe, concerted effort has gone into training firefighters, police, and ambulance officers to respond to incidents that involve hydrogen. Involving emergency services in planning projects increases community confidence and the likelihood of local support.

Review of existing training resources from both the USA and Europe has been completed. Packages reviewed to date indicate that the training content is dated in some respects and has fallen slightly behind emerging technologies. However, with minor updates to align content to relevant Australian regulations, Standards and educational requirements, the use of some existing packages may be suitable, and at a level that would meet the initial needs of Australian emergency responders.

Additional content will need to be developed to support the CHS training content, as it has a focus on passenger vehicle and transportation related response requirements.

Access to existing material has been sought by the project team and both the FCH JU and CHS are keen to pursue a partnership and support the development of the material for AFAC emergency responders. Additional content will need to be developed to support the CHS training content, as it has a focus on passenger vehicle and transportation related response requirements.

International Best Practice

The CHS and FCHJU HyResponse and Hy Responder projects are established on a comprehensive and technically robust knowledge base. These two bodies of work reflect a coordinated and collaborative approach to the development of holistic and on-going educational resources. They are considered to be international best practice in the delivery of hydrogen awareness and response training programs to emergency responders within the respective jurisdictions.

Further validation supporting this assessment will be achieved through the continued review of materials and engagement with both organisations validation will occur within the implementation phase of the AFAC Emergency Services Training Analysis project.

Center for Hydrogen Safety (CHS) AIChE

The Project Team has engaged with CHS over the course of this training analysis. Review of training materials developed by the CHS indicates the material is suitable for Australian emergency services and can be provided at a cost. It is important to note that the CHS material has been based on content developed by the FCH JU consortium. The content, while relevant, may need to be refreshed to keep pace with the emerging technology and landscape in Australia. Layered or tiered training packages are available, catering to the segmented approach preferred by AFAC member agencies.

The CHS website and H2Tools page hosts an open resource, wealth of information for emergency responders, including vehicle emergency response guides for hydrogen fuel cell vehicles, a bulk hydrogen transportation and refuelling infrastructure related scenarios. This is pertinent to emergency responders in the Australian Capital Territory (ACT), and Queensland (QLD) with governments in these states participating in fleet trials of hydrogen fuel cell vehicles and within the private sector.

Use of the CHS E-Learning package would provide a quick win option for Australia, enabling a fast but timely rollout for all agencies as determined by their hydrogen risk. However, the training content within these packages focuses on passenger vehicle, transportation, and refuelling response scenarios. The CHS content currently would not cover all of the training aspects required to equip Australian emergency responders as hydrogen technology and market matures. Additional content would require development to support an initial roll-out of the CHS E-Learning package.

CHS have submitted an indicative quote (Appendix E) to provide the training packages detailed below.

E-Learning First Responder Hydrogen Safety[10]

CHS have an E-Learning package that is suitable as a base line hydrogen awareness training package. The 4-part multimedia course aims to better inform emergency responders and supports the safe handling and use of hydrogen in a variety of fuel cell applications. Access is provided for one year and the cost of adaption to each agency's Learning Management Systems (LMS) is included.

The package covers all hydrogen fundamentals, CHS have capacity to provide access with a short lead time, at relatively low cost of $1 USD per participant.

Total cost for AFAC Emergency Responders is $75,000 USD, for 75,000 participants (or $1 USD per participant) prepayment applies, and taxes are additional. At the time of obtaining the quote from CHS it was anticipated that there would be approximately 75,00 participants however through stakeholder engagement session it was identified the number may be closer to 100,000. Each unit cost is $1 USD per participant.

In-person instructor led train the trainer - Develop a hydrogen training capability

CHS will deliver two four-hour sessions over 5 continuous days at a Sydney training facility. The objective being to develop a training capability within each AFAC member agency. This option will prove to be a costly exercise given the practicalities of international and interstate travel in a pandemic environment. The expense of bringing a CHS training team to Australia and all AFAC member agency trainers to Sydney for a four-hour training session may not be an efficient use of funds for agencies. The unpredictable pandemic environment in conjunction with fluctuating state-based restrictions may prove too risky in the short term.

The cost for CHS to provide this training is $40,000 USD, plus applicable taxes, reproduction of course materials and travel expenses. AFAC member agency costs are in addition to this.

Virtual instructor led first responder hydrogen safety - Develop a training capability

CHS will deliver two online four-hour sessions over 5 continuous days, a total of 10 sessions through a virtual training platform, such as Teams or Zoom. Participants will attend one four-hour session. The objective being to develop a training capability within each AFAC member agency. This option may prove to be a suitable method given the practicalities of international and interstate travel in a pandemic environment.

The cost to deliver a Train the Trainer package through an online platform is $30,000 USD, plus applicable taxes.

The project team are of the opinion that the CHS E-learning content represents a viable option to meet the short-term training needs of AFAC member agencies with acknowledgement that some minor content updates will be required to ensure compliance with Australian legislation, regulations, and standards. Take up of the CHS packages will not provide unlimited access to content or provide a sustainable training solution that keeps pace with an emerging industry.

Take up of the CHS packages will not provide unlimited access to content or provide a sustainable training solution that keeps pace with an emerging industry.

AFAC member agencies would need to source and pay for regular updated training for their training teams as the industry evolves, further increasing the financial pressure on agencies.

10 CHS First Responders Micro Training Learning Plan

Fuel Cell and Hydrogen Joint Undertaking (FCH JU)

HyResponse and HyResponder Projects

HyResponse is a 'Coordination and Support Action (CSA)' project supported by FCH JU, developed from June 2013 - September 2016. The project aimed to establish the world's first comprehensive training program for emergency responders to facilitate the safer deployment of hydrogen Fuel Cells and infrastructure.

The HyResponder project, which builds on the success of HyResponse, aims to develop and implement a sustainable train the trainer program in hydrogen safety for responders throughout Europe. The program supports the commercialisation of hydrogen and fuel cell technologies by informing responders involved in:

- permitting process
- improving resilience and preparedness, and
- ensuring appropriate incident management and recovery elements.

The Project team have engaged extensively with the FCH JU, and a review of all existing training content has been completed. The project team determined the FCH JU hydrogen training content and materials would meet the needs of AFAC emergency responders. Utilisation of FCH JU content will provide an efficient and cost-effective solution, with the potential to develop a long-term sustainable training solution.

FCH JU have existing baseline hydrogen awareness training content and are currently developing their train the trainer material. All training content is suitable for adaption to E-Learning delivery with the flexibility for adaption to face to face delivery.

HyResponse and HyResponder have not yet provided an open-sourced train the trainer resource package, however they have capacity for AFAC member agency trainers to attend the operational training component delivered collectively by Ulster University and ENSOSP - National School of Firefighting Officers. The content of this operational training course has been reviewed by the project team and will address the need for Australia.

Review and suitability of FCH JU Content

Acting Superintendent Trent Brown attended a planning workshop for the HyResponse / HyResponder project in June 2021. The program was conducted over 5 days and hosted by FCH JU, Ulster University, the French National Fire Officers Academy (ENSOSP) and was attended by 10 countries that are members of the consortium.

Acting Superintendent Brown viewed all material for all training segments through an Australian emergency responder lens and assessed the material as suitable for Australian needs. There is potential to refresh the practical demonstrations and visual material with Australian content to make the learning experience more relevant and applicable to Australian emergency responders.

Partnering with FCH JU

Partnering with the FCH JU provides an opportunity for an Australian training collaborative group to build hydrogen training modules using international best practice content, with no charge for the use of the FCH JU content. There will be costs involved for Australia in developing the content into training modules. The creation of a package of training modules will fulfil the desire for agencies to deliver courses according to their hydrogen risk, while using nationally consistent content.

The research and subsequent development of training materials being undertaken by the European consortium is considered to be international best practice by the project team. The FCH JU consortium has a membership of over 15 countries, with representatives from industry and academia. Content is updated regularly and is keeping pace as the hydrogen landscape evolves across the globe.

Funding options for training delivery

When looking at the hydrogen industry and the expected growth from a financial and technological perspective, both Commonwealth and state governments are readily providing financial support to research bodies and private industry to incentivise development, to achieve both fiscal and environment benefits to policy initiatives. Governments and industry are targeting full-scale adoption of hydrogen in many regions and in several domains, ranging from energy storage to consumption in transport, buildings, and industry. This requires the rollout of a diverse range of supporting infrastructure so that hydrogen can be produced, moved, stored, distributed, and integrated into the wider energy system. Hydrogen infrastructure must be built at large-enough scale, low-enough cost, and fast-enough speed to ensure the hydrogen economy can play a key role in the energy transition.

A safe hydrogen industry is essential to provide public confidence, and to this end a well-trained and well-equipped emergency service sector will be a critical aspect of providing this confidence. During stakeholder engagement activities, it was advised that responding agencies had no financial capacity to develop and deliver the additional content required to ensure effective and sustained response to the developing hydrogen industry. The cohort indicated that it is essential to develop a funding model that will provide the required support for all AFAC member agencies.

Options considered were:

- End user pays model – not considered viable as this penalises green energy initiatives.
- Agencies self-fund – limited budgets and resourcing make this option unviable.
- Commonwealth Government funded- preferred
- Government, industry, and academia partnership – preferred.

AFAC member agencies were united in their view that government and industry need to invest in the development of training resources for emergency service responders. The investment effort needs to be comparable with the support and initiative that is being provided to the development of the hydrogen industry in Australia. Funding streams available through government, industry and academia should be explored as viable options for funding emergency services hydrogen training.

AFAC member agencies involved in stakeholder workshops identified a need to rollout incremental stages of hydrogen training to all emergency responders, and to also plan for future training needs in both initial training and skills maintenance. As the hydrogen industry matures and escalates, so too does the risk of a hydrogen related emergency occur.

Support from government and industry will ensure hydrogen capability and emergency preparedness. A commitment of ongoing funding support to the emergency services sector should be planned and projected year on year until the hydrogen industry matures, at least until 2030.

Secondary unfunded agency expenses

An agency's capability to respond to an incident has many inputs. Training is just one input required to provide a response capability. Exploring capability inputs to enable and sustain an agency's ability to respond to a hydrogen incident is not within the scope of this project, however each capability input will have bearing on the preparedness for response.

Secondary costs to provide a hydrogen response include:

- Employee related expenses
- Equipment
- Agency specific learning education portal/website (if required).

Stakeholder engagement workshops revealed some AFAC member agencies with volunteer workforces do not have the required equipment to respond to a hydrogen related incident, for example appropriate gas detectors and thermal imaging cameras. Due to the unique burn characteristics of hydrogen this equipment would be considered a standard resource for any crew responding to a potential hydrogen incident. Provision of this equipment would be a significant unfunded expense.

AFAC member agencies are building practical learning environments which provide for the hands-on applied component of training. It was identified there will be cost to agencies involved in purchasing and building hydrogen specific training props or retrofitting existing props for hydrogen fuel. There is, however, opportunity for resource sharing and interagency collaboration in the training landscape.

The majority of AFAC member agencies have a learning management system (LMS), however, for some personnel access to the agency LMS is difficult at times due to the tyranny of distance or lack of technology/facilities. Agencies that do not have an adequate LMS system may incur costs to upgrade to a suitable platform. An open-sourced online repository or host website funded by government and industry as recommended in this report, may alleviate this issue. Hosting the content on an unrestricted public platform would also facilitate access to all potential non-emergency responders identified within this training analysis.

Detailed project recommendations

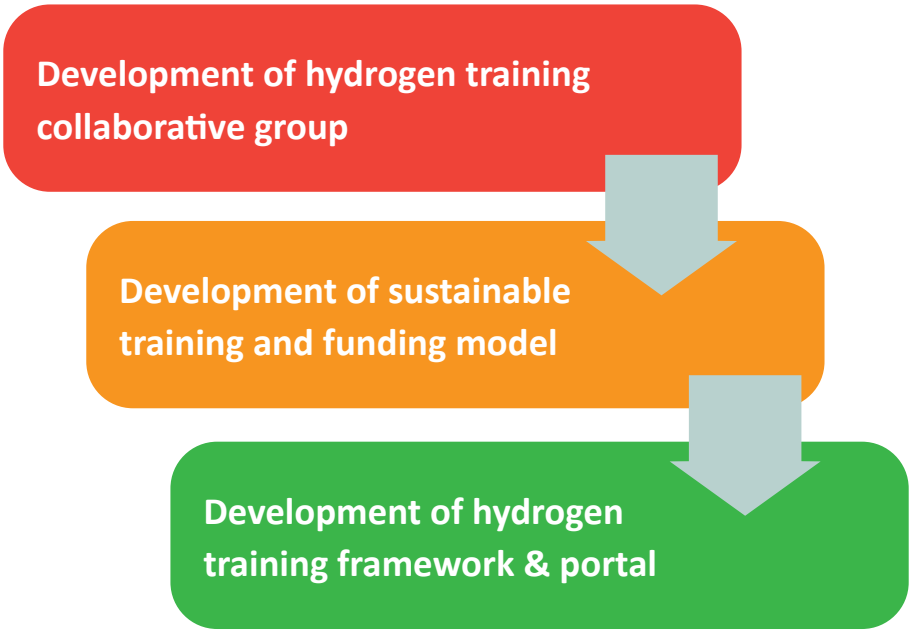
It is the opinion of the project team that the Australian emergency services will need to partner with government, industry, and academia to ensure that the response requirements to a developing hydrogen market are achieved in the short and long term.

Development of a training package designed for today's hydrogen market may not be sufficient in the future as the broad scope and fast paced advancement of hydrogen energy supply chain and end user applications are not clearly defined. Australia will need to embrace a collaborative, sustainable, adaptable, and innovative approach to meeting the training needs of emergency responders. The cohort of stakeholders engaged throughout this project have articulated varying levels of ability, resources, and funding to develop the hydrogen training content required to achieve capability and legislated service delivery requirements.

Most stakeholders indicated that provision of ready-made content, that could be either delivered as is or tailored to meet their jurisdictional needs, would be desired by their agency.

To achieve consistency and the sustainability required to meet training needs aligned with market development, the project team recommends that the following three bodies of work be adopted to ensure the safety of emergency responders as the hydrogen industry matures within Australia.

The project team recommends the following three actions to support the implementation of hydrogen training for emergency responders in Australia:



Development of a hydrogen training collaborative group

Emergency services

To ensure efficacy of training requirements in providing a safe response to hydrogen related emergencies, AFAC member agencies collectively agreed it will be essential to employ a collaborative approach when developing, reviewing, and implementing training resources.

It is recommended that representation from emergency service agencies, industry and academia form a collaborative group to address the needs of emergency responders. All three areas will be critical in leveraging the knowledge of the collective to develop hydrogen training materials that keep pace with an evolving industry and are robust and sustainable.

Emergency services will need to be engaged in this process and it is recommended that a call for participation goes out to the AFAC member agencies for nomination to participate in this collaborative. The broad scope of hydrogen production and applications, and need for developing segmented training modules, must be considered when agencies nominate their representatives.

Representation from the emergency services may include:

- Urban and Rural Fire
- Rescue
- Hazmat
- Volunteer Organisations
- Education and Training
- Virtual Training

Note: If representation is not achievable under this process, established frameworks may be a suitable option. AFAC working groups that may provide input: Urban Operations Group, Hazardous Materials (CBRN) Technical Group, Rescue Technical Group and the Learning and Development Group. www.afac.com.au/teams/all

Industry

A key factor in ensuring material is at pace with market direction will be the inclusion of industry in the stakeholder group. While aware of industry development through varying levels of engagement, it is not the key role of emergency services to be across all industry developments and, as such, will need input from industry subject matter experts (SME's) to ensure training is contemporary.

Representation at this level should include production, supply, and end user application with expressions of interest to be called for from stakeholders that have adopted an active and collaborative approach in the Australian energy sector to date. Those bodies that have engaged with the CSIRO HyResource work and are seen as market leaders would be recommended.

Industry representation could include:

- Hydrogen production
- Hydrogen supply
- Vehicle technology
- End user applications.

Note: If a call for participation is not desirable, the inclusion of representation from the CSIRO (Commonwealth Scientific and Industrial Research Organisation) HyResource project and partner organisations may provide the industry aligned input for the stakeholder advisory board.

Academia

Throughout stakeholder engagement sessions, it was clearly articulated that AFAC member agencies had established education and training directorates, and that these resources were at or near capacity with their current training requirements. Developing additional content for hydrogen related requirements would, in most cases, put finite resources under further strain. It is therefore recommended that inclusion of academia within the stakeholder collaborative group will be critical in this body of work.

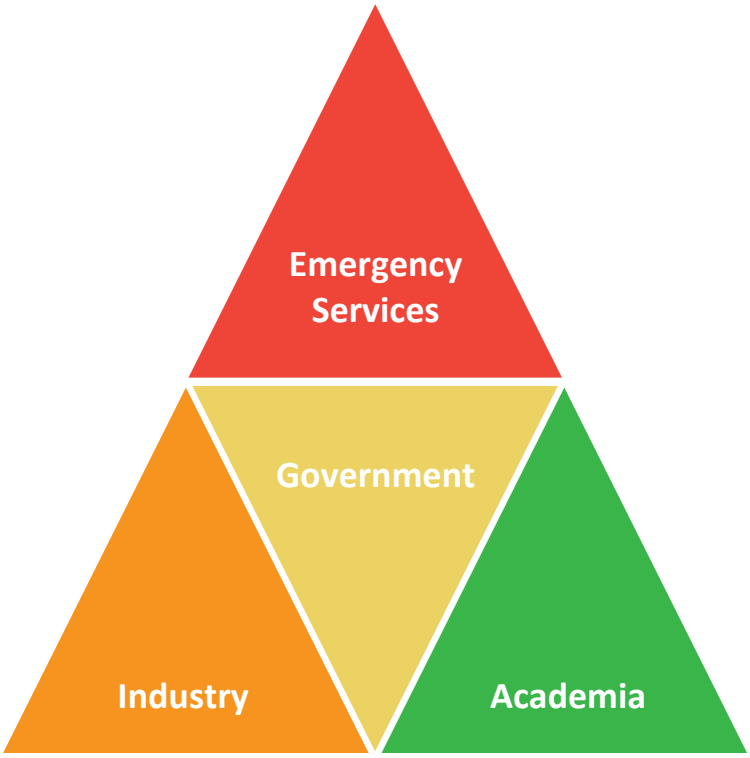
The hydrogen market is not yet defined and is expected to develop at a rapid pace. Tertiary institutions will be at the frontier of this advancement and will provide critical information and expertise required to develop training material consistent with vocational learning requirements and industry standards.

Commonwealth, state and territory governments are actively engaged with academic institutions, providing funding for research and development for hydrogen programs to ensure a safe and effective hydrogen industry. The academic community have teams working to lead these developments and, coupled with the funding model used, their expertise should be leveraged to contribute to Australian emergency responder safety.

Expressions of interest to engage in the stakeholder collaborative group should be called for from academia. This will provide support by including subject matter experts, from a hydrogen research development perspective, in the design of contemporary training and delivery models.

Development of the hydrogen training collaborative group will additionally provide a source of support for all agency partners, as the list of participants will be circulated to partner agencies as a source of information and advice.

Reporting lines between the collaborative group, the Commonwealth Department of Industry, Science Energy and Resources (DISER) and the South Australian Department of Energy and Mining who will lead the next stage the project will need to be established. This process will ensure and provide for government awareness and support as the collaborative seek to develop and sustain the adopted training model.



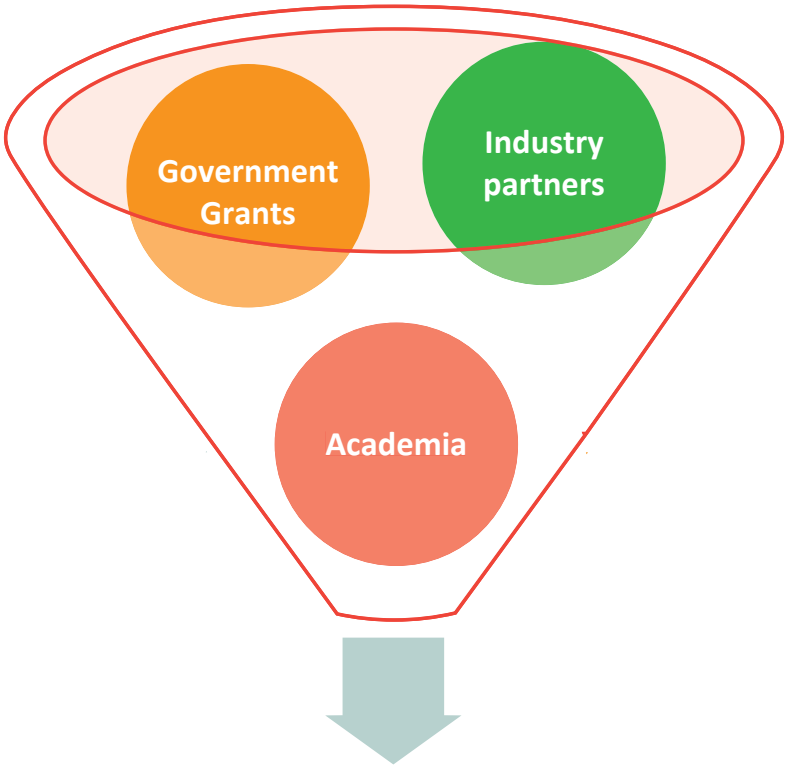
Sustainable funding model

Emergency services hydrogen training requirements will need to be designed to keep pace with the maturation of the Australian hydrogen industry. A sustained training model will be essential to ensure an effective and safe emergency response capability now and into the future as we see innovation and advancement of the hydrogen industry. Development of a funding model to support this sustainable approach will require a commitment to year-on-year funding, with an expectation that the hydrogen market and end user applications will not reach clarity and a level of maturity until 2030.

Overwhelmingly, the AFAC member agencies engaged through this project indicated financial resources required to develop and maintain the required sustainable training model were not readily available. The financial resources required would be outside of most agency's established training budgets. Financial support external to current funding would be required to meet the preparedness commitments identified within this report.

Development costs of the initial training packages are considered the most significant element of the project, with ongoing work to be added gradually as the market dictates. Initial material could then be incorporated into initial training and skills maintenance programs and become business as usual, with costs absorbed into these programs' existing frameworks. Specialist packages could then be developed and rolled out to targeted cohorts at a reduced cost than the initial development /implementation phase.

Through the National Hydrogen Strategy 2019, the Australian Government has positioned policy and financial support mechanisms to support development within the hydrogen industry. The expansion of response requirements attributed to the adoption of hydrogen applications will add pressure to finite resources within the emergency services community. These costs will not only be linked to training, but to the development of a fully functioning POISTED capability for hydrogen response. As such, it is recommended the Commonwealth government provide financial support to emergency services at pace with its investment in research and industry initiatives as it seeks to achieve greenhouse reduction targets.



Emergency Services hydrogen training development

Development of a hydrogen training portal

It is recommended that the development of an open-sourced training portal providing peer reviewed on-going and sustainable training resource for all Australian emergency responders will deliver the training needs of Australian emergency services as the hydrogen industry develops.

A mandated national training program, with limited or no flexibility in content, may not be achievable or required given the varying needs of the emergency responder communities. Development of a repository of content, aligned to agency training specificities, will provide a platform enabling each service to access nationally consistent material and training resources that can be structured and delivered according to their organisational needs.

Development of the open-sourced model will also provide training content and support to stakeholders not defined within the parameters of this project.

Hydrogen market triggers will indicate to each jurisdiction when to activate training delivery. Market triggers can also be utilised to initiate further development of segmented training materials and resources as they are identified and required. The project framework will need an enduring commitment from all stakeholders to ensure sustainability and long-term effectiveness to the emergency service community.

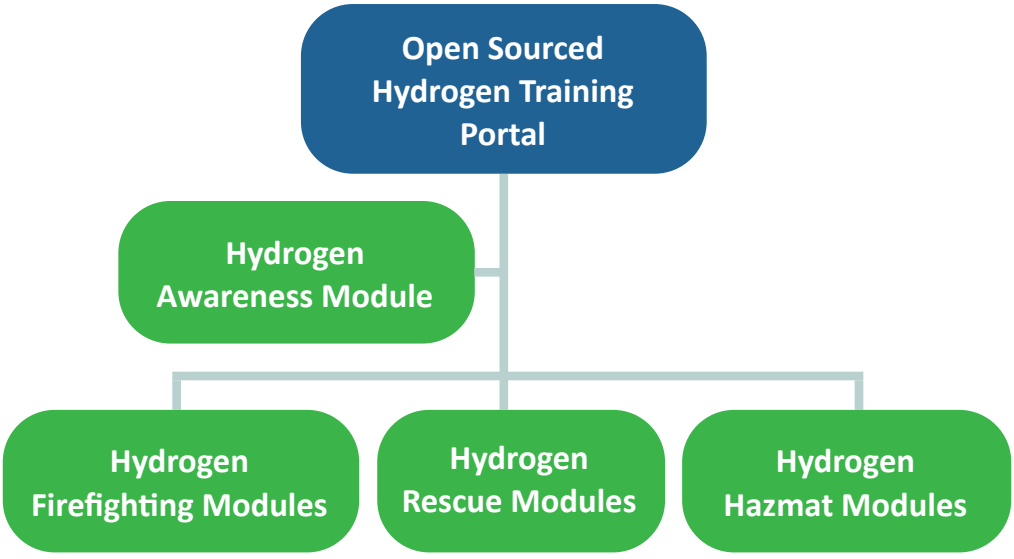
The environmental scan of world best practice has focused on hydrogen training models developed in the more mature marketplaces of Europe and the United States. Emergency responders in these markets have been supported by the Fuel Cells and Hydrogen Joint Undertaking (FCH JU) HyResponse and HyResponder projects in Europe, and the American Institute Chemical Engineers (AIChE) Centre for Hydrogen Safety in the US.

Both projects have utilised a similar approach to the model recommended in this report, harnessing the collective resources of emergency services, industry, tertiary education, and government bodies to develop training modules on an open-sourced web-based platform.

Resources for these projects have been developed over sustained periods, with the FCH JU initiating the HyResponse project in 2013 and transitioning into delivery of the HyResponder project currently underway. Materials developed within the HyReponder project have had extensive consultation and review prior to delivery, with the final materials being tailored to national requirements.

Utilisation of the FCH JU material to build modules of training content will meet the needs of a changing training environment which will be required as the hydrogen industry matures into the foreseeable future.

The CSIRO HyResource project is a similar collaboration, not for training, but to collate core information around projects, policies and key organisations involved in the research, development, and deployment of clean hydrogen as a low-emissions energy source. In the way this model is being utilised to support industry, a parallel body of work embracing similar methodology to support emergency services is recommended.



Appendices

A. Statement of Requirement

B. AFAC Response to the Statement of Requirement

C. Stakeholder engagement register

D. AFAC members agency workshop presentation

E. CHS First Responder Training Estimate of Costs

F. Project Governance

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