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# TVET SKILLS FOR RENEWABLE ENERGY AND GREEN HYDROGEN IN NAMIBIA

## Annexure 10: Occupational Health and Safety

Implemented by

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# ACRONYMS

| | |
|---|---|
| AIA | Approved Inspection Authorities |
| ECB | Electricity Control Board |
| GCF | Green Climate Fund |
| $GH_2$ | Green Hydrogen |
| GIZ | Deutsche Gesellschaft für Internationale Zusammenarbeit |
| GWO | Global Wind Organisation |
| HCDC | Hydrogen Safety Curriculum Development Committee |
| IAHySafe | International Association for Hydrogen Safety |
| IEA | International Energy Agency |
| IEC | International Electrotechnical Commission |
| ILO | International Labour Organisation |
| IRENA | International Renewable Energy Agency |
| ISO | International Organisation for Standardisation |
| MEIYSAC | Ministry of Education, Innovation, Youth, Sport, Art and Culture |
| MEFT | Ministry of Environment, Forestry and Tourism |
| MHSS | Ministry of Health and Social Services |
| MoJLR | Ministry of Justice and Labour Relations |
| MIME | Ministry of Industrialisation, Mines and Energy |
| NamPower | Namibia Power Corporation |
| NCHE | National Council for Higher Education |
| NEBOSH | National Examination Board in Occupational Safety and Health |
| NEI | Namibia Energy Institute |
| NIMT | Namibia Institute of Mining and Technology |
| NSI | Namibia Standards Institute |
| NQA | Namibia Qualifications Authority |
| NQF | National Qualifications Framework |
| NTA | Namibia Training Authority |
| NUST | Namibia University of Science and Technology |
| NVC | National Vocational Certificate |
| NVD | National Vocational Diploma |
| OECD | Organisation for Economic Co-operation and Development |
| OHS | Occupational Health and Safety |
| OSHA | Occupational Safety and Health Administration |
| PPE | Personal Protective Equipment |
| RE | Renewable Energy |
| SABS | South African Bureau of Standards |
| SAQA | South African Qualifications Authority |
| SHE | Safety, Health and Enviroment |
| TVET | Technical and Vocational Education and Training |
| TWG | Technical Working Group |
| TÜV | Technischer Überwachungsverein (Technical Inspection Association) |
| UNAM | University of Namibia |
| UNIDO | United Nations Industrial Development Organisation |
| VTC | Vocational Training Centre |

# 1

# ANALYTICAL REPORT

## 1.1 Status quo, overview of existing training measures and training providers

### Introduction

Namibia's Occupational Health and Safety (OHS) and firefighting training ecosystem is well-established for general industrial sectors but remains underdeveloped in the context of renewable energy (RE) and green hydrogen ($GH_2$) sectors. While foundational OHS and fire safety competencies are available, the sector lacks specialised training for hydrogen-specific hazards.

Namibia's green energy transition, especially with the development of RE sources such as solar, wind, hydropower, geothermal, and biomass, is accompanied by the growing importance of the hydrogen sector. As the country moves toward scaling these technologies, the demand for specialised training in OHS and firefighting becomes critical. The safe deployment of these technologies, particularly hydrogen infrastructure, requires addressing significant gaps in training, especially when it comes to sector-specific hazards and firefighting competencies.

Training providers, both public and private, need to focus on integrating hydrogen safety and firefighting competencies into their curricula. Moreover, addressing the lack of accredited hydrogen-specific certifications, trainers, and practical simulation infrastructure is critical to ensure the safe deployment of hydrogen technologies. While progress is being made, Namibia's OHS training landscape requires significant improvements to adequately prepare the workforce for the specialised needs of the $GH_2$ economy.

### Policy, Regulation, and Strategic Development

The training landscape for OHS and firefighting in Namibia's RE and $GH_2$ sectors remains fragmented and underdeveloped, particularly in the areas of policy, regulation, and strategic development.

Most public institutions — including the Ministry of Education, Innovation, Youth, Sports, Arts and Culture (MEIYSAC), the Ministry of Justice and Labour Relations (MoJLR), the Ministry of Industrialisation, Mines and Energy (MIME), and the Ministry of Environment, Forestry and Tourism (MEFT) — as well as national statutory bodies such as the Namibia Training Authority (NTA), Namibia Qualifications Authority (NQA), National Council for Higher Education (NCHE), and the Namibian Standards Institution (NSI), serve primarily as regulators, facilitators, and coordinators rather than direct training providers.

Training frameworks offered through Technical and Vocational Education and Training (TVET) institutions and universities focus mainly on general industrial safety, with little or no specialised content on hydrogen-related hazards. Private training providers deliver general fire safety training, but these programmes are rarely benchmarked against international standards.

Trainers also frequently lack formal recognition as competent persons under national regulations (Government Notice No. 156 of the Labour Act, No. 6 of 1992).

Regulations 1 and 18 stipulate that "no person may perform any inspection function, investigation, testing, sampling, analysis or training unless he or she is in possession of a valid certificate signed by the Chief Inspector...", while Regulation 51.b requires that "an employer shall appoint such competent persons as may be necessary to assist him or her in enforcing compliance with these regulations."

In practice, training infrastructure is outdated, and institutional capacity to design and deliver hydrogen-specific safety training is severely limited.

Strategic initiatives such as the Namibia Green Hydrogen Programme (NGHP), the Namibia Green Hydrogen Association (NGHA), and the Nam-$H_2$ Fund Managers are instrumental in building partnerships and supporting policy coordination. However, their involvement in OHS and hydrogen-specific firefighting training has so far been minimal, with most efforts directed towards broader technical and strategic development.

At the international level, organisations such as the International Organisation for Standardisation (ISO), International Electrotechnical Commission (IEC), International Labour Organisation (ILO), International Renewable Energy Agency (IRENA), United Nations Industrial Development Organisation (UNIDO), Occupational Safety and Health Administration (OSHA), Organisation for Economic Co-operation and Development (OECD), Hydrogen Europe, and the International Association for Hydrogen Safety (IAHySafe) provide valuable standards, frameworks, and guidance. Yet, these resources have not been fully localised or translated into accredited training programmes in Namibia, leaving a gap in readiness for deploying high-risk hydrogen infrastructure.

**Key Points to Take Away**

- No accredited hydrogen-specific firefighting training or qualifications.
- Lack of unit standards and certification pathways in hydrogen safety.
- No institutional capacity for hydrogen-focused safety simulations

(while institutions can deliver generic safety training, they lack the ability to provide practical application and rescue training in areas such as confined space entry, working at heights, and lockout procedures for energy sources).

- Trainers are not formally recognised as hydrogen fire safety experts under national law.
- Training infrastructure is misaligned with international hydrogen safety standards.

## Accredited Certifications and Qualifications

Accredited certifications are provided by national authorities such as the Namibia Training Authority (NTA), the Namibia Qualifications Authority (NQA), and higher education institutions like NUST and UNAM. While international training partnerships exist, they are mainly concentrated in renewable energy sectors such as solar, with only limited modules directly focused on hydrogen.

These institutions coordinate the development of NQF-registered qualifications and unit standards, ensuring that OHS training is structured, recognised, and responsive to industry needs. Through Technical Working Groups (TWGs), representatives from industry, training institutions, and subject matter experts collaborate to review and upgrade existing OHS qualifications and to design new ones.

These qualifications aim to cover both traditional sectors (e.g. mining, construction, manufacturing) and emerging industries, including oil and gas, renewable energy, and hydrogen.

## Role of Accredited Training Providers

Accredited training providers deliver and implement OHS programmes in practice. Operating under the governance of the NTA and quality-assured by both NTA and NQA, these providers offer certificate and diploma programmes that meet national standards. They also play a key role in rolling out short courses and competency-based modules tailored to workplace-specific OHS risks.

Approved Inspection Authorities (AIAs), recognised by the Ministry of Justice and Labour Relations (MoJLR), often partner with training providers to provide industry insights, support practical assessments, and ensure the real-world application of OHS principles. AIAs also act as a bridge between regulation and practice, feeding back into curriculum development by highlighting skill gaps and emerging safety demands.

## Short Courses and Approved Inspection Authorities

In Namibia, short courses in OHS are generally not accredited by the NQA, as the NQA focuses on formal qualifications aligned with the NQF. Instead, these short OHS-related training programmes are delivered by entities recognised as AIAs. Such providers are authorised by relevant ministries, for example:

- MoJLR (general OHS training and legal compliance)
- Ministry of International Relations and Trade
- Ministry of Health and Social Services (MHSS) (for health-related training such as First Aid).

AIAs typically offer modular, outcomes-based training on workplace health and safety competencies, including Hazard Identification and Risk Assessment (HIRA), Incident and Accident Investigation, Firefighting, First Aid, Working at Heights, and the roles and responsibilities of SHE Representatives. While not formally NQA-accredited, these courses are legally recognised by regulatory authorities and often required for compliance with Namibian labour and safety legislation. In some cases, course content aligns with NQF OHS unit standards, though without awarding an official qualification.

Training by AIAs is highly practical and aligned with regulatory frameworks. Many courses can be customised to address site-specific hazards and operational needs. Employers across high-risk sectors such as mining, construction, logistics, and manufacturing rely on these short courses to ensure employee competence, comply with inspections, and meet legal obligations.

## Training and Development Landscape

The National Vocational Certificate (NVC) in Preventive Health (NQF Level 4) with specialisations in Supervisor and Safety Representative, and the National Vocational Diploma (NVD) in Preventive Health (NQF Level 5) in Occupational Safety and Health Management, are accredited by the NQA and delivered by Vocational Training Centres (VTCs) and other institutions under the governance of the NTA.

While these programmes provide a recognised framework for OHS training, they remain largely theoretical, with a focus on general workplace safety representation and management.

They do not yet address the specialised OHS needs of the RE and $GH_2$ sectors. The NTA's Technical Working Group (TWG) has recently reviewed these qualifications with the aim of extending progression to NQF Level 6. However, the revised versions are not yet registered and continue to lack sector-specific content tailored to emerging industrial contexts.

**National Vocational Certificate (NVC) in Preventive Health (Occupational Health and Safety), Level 4**

| Institution | Approved Trainees Capacity Enrolment |
|---|---|
| DayDream Institute of Training and Skills Development | 30 |
| Ngato Institute of Science and Technology | 15 |
| Nile Vocational Training Centre | 12 |
| R.I.K. Technical College | 70 |
| Shalom Vocational Training Centre | 20 |

**National Vocational Certificate (NVC) in Preventive Health (Occupational Health and Safety), Level 4 and National Vocational Certificate NVC) in Preventive Health (Level 5), (Occupational Health and Safety), Management**

| Institution | Approved Trainees Capacity Enrolment |
|---|---|
| Northgate Technical College | 20 |
| PMT Health Care Institution | 20 |
| Ondangwa Commercial College | 35 |
| Atlantic Training Institution | 70 |
| Atlantic Training Institution | 40 |
| St. Anthony Universal College | 40/30 |
| Heritage Management Institute | 20 |
| Symanek Training Academy | 20 |
| Johny and Panduleni Vocational Centre | 20 |
| Millenium Vocational Digital Training Institute | 20 |
| Brave and Achiever College of Artisans | 25 |
| Namibia College of Open Learning (Windhoek) | 40 |
| Ngato Institute of Science and Technology | 25 |
| W.N. Occupational Safety and Health Academy | 30 |

**Selected Sector and Entity-Specific Training Status: The following table provides a snapshot of sector-specific training provision and its alignment with $GH_2$ and RE needs:**

| Provider and Institution | Current Training Focus | Hydrogen and RE-Specific Training Status |
|---|---|---|
| Africa Fire and Rescue 24 | General fire safety and emergency response | No hydrogen-specific curricula |
| EVTC, Brave and Achiever College | Vocational trades with embedded general OHS | No hydrogen modules or certified trainers |
| NAMCOL, COSDEF | Basic fire safety, first aid, health and safety | No hydrogen-specific risk or firefighting training |
| Global Wind Academy, Maersk Training | International renewable energy safety (wind) | Hydrogen modules piloted but not fully available |
| West Fire Training and Consulting | Firefighting and emergency response | No hydrogen-specific modules; limited capacity |
| Youth for Green Hydrogen (Y4H2) | Academic and technical training | Limited explicit OHS or firefighting content |
| Private Consultancies (e.g., Awene Safety) | General OHS and compliance | Lacking hydrogen technical depth |

## Synopsis of current Training Provision in Namibia

The training ecosystem for OHS and firefighting in Namibia is well-established within traditional sectors like mining, construction, manufacturing, and logistics. Providers include universities, vocational training centres (VTCs), private consultants, and community outreach units.

Training is delivered through diverse modes such as classroom theory, practical drills and simulations (mainly for traditional industrial hazards), mobile training units reaching remote areas, and digital or blended platforms.

Together, these providers form a comprehensive landscape that spans emergency response, workplace safety, heavy equipment operation, and specialised technical services. They can be grouped into five main clusters:

- **Firefighting and Emergency Response Providers:** A core group of institutions specialises in fire prevention, emergency preparedness, and hazardous materials management. They deliver training in basic and advanced firefighting, emergency evacuation, hazardous materials (HAZMAT), breathing apparatus, and rescue operations.

  Providers such as Africa Fire and Rescue 24, Fast Fire Services, Anoldito Engineers, Khomas Fire Risk Consultants, Khoisan Fire and Safety Solutions, West Fire Training & Consulting, and WestAir Medical Rescue Africa fall into this category.

  They also service and certify firefighting equipment and, in some cases, operate in line with international benchmarks such as NFPA and ASIB standards.

- **General OHS and Safety Management Providers:** Another cluster focuses on broader occupational safety and risk management. These institutions offer training in health and safety representation, hazard identification and risk assessments, incident investigation, SHEQ implementation, auditing, and compliance with ISO or NEBOSH frameworks.

  Examples include Atlantic Training Institution, Global Edge Training Institute, Deme Investment, Sanprof Safety Namibia, Shadonai Training Centre, Komesho Skills Development CC, All-Safe Training and Consulting, Awene Safety Consultancy, Likius Health and Safety, Royal Safety Health and Environmental Consultancy, and SHEQ Eyeq Consultancy.

  They often integrate basic firefighting, first aid, confined space, and working-at-heights modules.

- **Heavy Equipment Operation and Rigging Training Providers:** A third group combines OHS elements with extensive heavy equipment and lifting training.

  Institutions such as Alpha Training and Maintenance CC, Nirvana Academy and Investment, Pegasus Training Practice, Symanek Investment, Advance Driving Academy, CJ Namib Trading, Cynric and Lynn Trading Enterprises, Enzo Trading Enterprises, Evelyn Fisch Investment, Kharas Training Academy, Logistics Training Services, Namibia Industrial Operators Training, and Zone Safety Academy deliver programmes on cranes, forklifts, graders, excavators, dump trucks, defensive driving, rigging, and slinging.

  These courses are directly relevant for construction, mining, transport, and heavy industry operations, while embedding OHS requirements such as fall arrest, confined space entry, and spill containment.

- **Specialised Technical and Inspection Services:** Finally, a number of providers focus on niche areas of industrial safety, equipment inspection, and compliance.

  This includes Benguella Enterprises, Eliz Gas Technology, Okakuyu Fire and Plumbing Services, Olyfberg Investment, Southey Namibia, Hüster Machinetool, Izzy Cranes, JM Engineering Services, Matcon Investments, Namibian Uranium Association, National Environmental Health Consultants, ND Diverse Training, Nenos Enterprises, Neodana Investment, Oasis Capital, Precision Rigging Operations, PS HSE Consulting, Qinlao Trading, Raysonic Inspection Test and Certification, Rentech Trading, Rhyn Asset Management, SHEQ Twenty Four Seven Investments, Six Thirty-Three Safety Solutions, Technical Environment Training, and Wavetec Inspection and Training Services.

  Their competencies include boiler and pressure vessel testing, LPGAS installations, asbestos removal, rope access, non-destructive testing (NDT), radiation safety, occupational hygiene, and certification of lifting and rigging equipment.

- **Higher Education Institutions (NUST and UNAM):** In addition to VTCs and private providers, Namibia's universities play an important role in advancing OHS training with a focus on renewable energy and green hydrogen.

  The Namibia University of Science and Technology (NUST) offers degree programmes such as the Bachelor of Environmental Health Sciences and the Master of Sustainable Energy Systems, alongside targeted initiatives including the Green Hydrogen Summer and Winter School, SOLTRAIN+ workshops, and laboratory-based Solar PV safety training.
  These equip graduates and technicians with competencies in occupational hygiene, risk management, hydrogen safety, and renewable energy systems.

  The University of Namibia (UNAM) complements this provision with a Postgraduate Diploma in Occupational Safety and Health, the planned MSc in Renewable Energy Engineering, and specialised short courses through its Climate Change Programme and the Namibia Green Hydrogen Research Institute (NGHRI). UNAM also contributes through international collaborations and PhD research in hydrogen safety.

  Both NUST and UNAM add academic depth, research capacity, and hydrogen-specific training to Namibia's OHS ecosystem, bridging foundational qualifications and industry-focused specialisations.

Together, these five clusters illustrate the breadth of Namibia's OHS and firefighting training ecosystem — from emergency response and safety culture, through industrial equipment operation, to highly specialised inspection services and higher education research.

While this system is fairly extensive, most programmes remain generic, with limited hydrogen-specific content currently integrated.

Strengthening curricula to address hydrogen-related hazards will be essential to prepare the workforce for the demands of the green hydrogen and renewable energy sectors.

**For a full list of providers and their detailed competencies, please refer to Chapter 8.1, 8.2, 8.3 and 8.4 (Comprehensive Lists).**

## Summary and Sector Implications

OHS courses in Namibia remain a cornerstone of workforce development. Delivered by competent AIAs and sector specialists, they are officially authorised by the relevant ministries and widely recognised as a standard for training and compliance across industries.

However, the renewable energy and hydrogen sectors face specific challenges: limited hydrogen-focused content, gaps in technical capacity, and a need for upgraded frameworks. Addressing these gaps through targeted interventions will be critical to ensuring safe operations in Namibia's emerging RE and $GH_2$ industries.

## 1.2 International Benchmarking in Occupational Health and Safety for the RE and $GH_2$ Sectors

International experience shows that the rapid growth of RE and $GH_2$ industries has been accompanied by the establishment of robust safety frameworks.

These frameworks integrate OHS standards, hydrogen-specific regulations, and certified training pathways to mitigate the unique risks of hydrogen, including flammability, invisible flames, toxicity, and cryogenic storage hazards. Together, they provide Namibia with a strategic reference point for developing its own OHS systems and training infrastructure.

### Global Standards and Frameworks

The global RE and $GH_2$ sectors are guided by internationally recognised standards that ensure effective health, safety, and firefighting protocols. These standards can be grouped into four categories:

**Occupational Safety Management Systems**

- **ISO 45001:** The global benchmark for occupational safety and health management systems. It provides a model for integrating hydrogen-specific hazard identification, risk management, and emergency response training into national curricula.
- **ILO Conventions (C155, R164), NEBOSH, IOSH:** These frameworks provide competency standards for OHS professionals. Increasingly, they include hydrogen-related modules to prepare workforces for new risks.

**Hydrogen-Specific Safety Codes and Guidelines**

- **NFPA 2 (Hydrogen Technologies Code):** A widely applied standard across the USA, EU, and Japan, offering detailed hydrogen safety and firefighting guidance for facility operations, emergency response, and fire protection.
- **IEC 60079 and IECEx Certification:** Standards covering explosive atmospheres and intrinsically safe equipment, critical in environments with hydrogen exposure.
- **CompEx Certification (UK):** Specialised training and certification for hazardous environments and explosion risk management, directly applicable to hydrogen.
- **ISO/TR 15916 and ISO 19880-1:** Technical guidelines for handling hydrogen safely in production, storage, and refuelling contexts.
- **ISO 19880:** Specific guidance for the safety of hydrogen refuelling stations.

**Equipment and Process Standards**

- **ISO 22734:** Requirements for the design, safety, and performance of electrolysers.
- **ISO 16111**: Standards for portable hydrogen storage systems, especially metal hydrides.
- **ISO 14687 and DIN EN 17124:** Purity and quality requirements for hydrogen used in fuel cells and other applications.
- **ASME B31.34:** Standards for hydrogen piping systems.
- **CGA H-3-2019:** Standards for cryogenic hydrogen storage.

**$H_2$-Ready Systems**

Germany's Technical and Scientific Association for Gas and Water (DVGW e.V.) defines "$H_2$-ready" systems as those where technical, legal, operational, and organisational requirements are met. This approach highlights that safety is not only about engineering solutions (e.g. gas detection, non-sparking tools, PPE) but also about workforce training and operational preparedness.

### International Training and Certification Bodies

Several international organisations set the standard for hydrogen safety training and certification. Namibia could leverage these partnerships to build domestic capacity:

- **TÜV Rheinland and TÜV SÜD (Germany):** Certification for hydrogen safety professionals, with specialised courses on firefighting, leak detection, and emergency response.
- **DNV (Norway):** Training in hydrogen safety engineering, including risk simulation and explosion prevention.
- **SGS and Bureau Veritas:** Accredited hydrogen safety and firefighting courses, with strong emphasis on simulation-based training.
- **HySafe, Hydrogen Europe, European Hydrogen Safety Panel (EHSP):** European knowledge hubs promoting harmonised standards and emergency toolkits.
- **National Fire Protection Association (NFPA, USA):** Leading provider of hydrogen firefighting certifications and resources such as $H_2$ Tools.
- **International Association for Hydrogen Safety (IAHySafe):** Expert-led workshops and training aligned with hydrogen safety standards, focusing on risk assessment and emergency preparedness.

### Training Models and Best Practices by Region

**Europe:** Europe is leading in building a sustainable hydrogen infrastructure, particularly through the EU Hydrogen Strategy. There are numerous hydrogen refuelling projects, pipelines, and cross-border logistics systems, with an emphasis on green hydrogen.

- Training institutions include European Hydrogen Safety Training Centres, the European Hydrogen Association (EHA), and national centres in Germany and the Netherlands.
- $H_2$ University in Norway offers specialised courses in hydrogen safety and renewable energy integration.

**Asia:** Asia, particularly Japan, South Korea, and China, has developed strong hydrogen safety ecosystems.

- **Japan:** Operates advanced hydrogen safety training centres and the Hydrogen and Fuel Cell Demonstration Project, with specialised training for technical staff and emergency responders.
- **South Korea:** Hosts the Hydrogen Safety Training Institute, offering courses for industry, emergency services, and facility operators.
- **China:** Through universities and research institutes, integrates hydrogen safety training into its aggressive national hydrogen development strategy.

**United States:** The USA has a growing hydrogen infrastructure, with California leading in refuelling stations and pilot projects.

- NFPA provides hydrogen-specific training and certification for firefighters, engineers, and operators.
- The DOE Hydrogen and Fuel Cell Technologies Office runs workshops and programmes for professionals.
- Universities and private institutions such as Caltech provide hydrogen handling and emergency management training.

**Africa:** Several African countries are beginning to integrate hydrogen into their energy transitions:

- **South Africa**: The Hydrogen South Africa (HySA) programme promotes R&D and training in hydrogen production, storage, and utilisation. Pilot plants for green hydrogen are operational, and projects in transport and export infrastructure are expanding. South Africa's abundant solar and wind resources underpin its ambitions.
- **Egypt:** Develops solar-based hydrogen projects with a focus on exports to Europe and Asia. Pilot plants and infrastructure plans are underway.
- **Morocco:** Embedding hydrogen into its renewable energy strategy, with plans for both export and domestic industrial use.
- **Other African states:** Many are still in the strategy and pilot project phase, seeking international partnerships to develop training, infrastructure, and safety know-how.

**Comparative Perspective**

- **Europe:** Clear policy frameworks, infrastructure roll-out, and training integration.
- **Asia:** Pioneering hydrogen mobility and industry integration with specialised training centres.
- **USA:** Expanding infrastructure, training through NFPA and DOE, and strong university engagement.
- **Africa:** Early-stage development, with South Africa most advanced through HySA, while Egypt and Morocco are positioning for exports.

## International Development Support

Multilateral and regional actors play a vital role in knowledge transfer, capacity building, and harmonisation of hydrogen safety standards:

- **European Commission, IEA, ILO, IRENA:** Provide technical assistance, funding, and policy guidance.
- **UNIDO and SACREEE:** Support curriculum localisation, trainer accreditation, and safety programme development.
- **SASSCAL:** Facilitates knowledge exchange and regional alignment in Southern Africa.

## Conclusion

International benchmarking highlights clear regional differences in hydrogen safety and OHS development.

Europe is furthest ahead, anchored by the EU Hydrogen Strategy, extensive refuelling networks, and cross-border infrastructure, while Asia — particularly Japan, South Korea, and China — is driving large-scale adoption through hydrogen mobility, national institutes, and aggressive industrial roll-outs. The USA is somewhat less advanced in infrastructure, but leads in innovation and pilot projects, with California as a frontrunner.

In Africa, countries are at an earlier stage. South Africa has established the HySA programme and pilot plants linked to its strong renewable base, while Egypt and Morocco are preparing hydrogen strategies to leverage solar and wind resources for future export markets. Across the continent, however, safety standards, training, and emergency response systems remain in their infancy.

These examples show that successful hydrogen economies combine infrastructure development with robust OHS frameworks, internationally aligned standards, and accredited training.

For Namibia, the lesson is clear: while the country can build on global best practice, significant gaps remain in its own training, certification, and regulatory systems. The following chapter explores these gaps in detail, measured against the benchmarks outlined above.

## 1.3 Needs and Gap Analysis: OHS in Namibia's Renewable Energy and $GH_2$ Sectors

The international benchmarking shows that leading countries in RE and $GH_2$ rely on robust OHS standards, regulatory frameworks, and structured certification systems.

These include global benchmarks such as ISO 45001, NFPA 2, and IEC 60079, as well as simulation-based training models and internationally recognised certification pathways offered by providers such as TÜV, DNV, and NFPA. Together, they form a clear reference point for Namibia as it develops its own safety training and regulatory frameworks.

Against this backdrop, Namibia's OHS ecosystem for RE and $GH_2$ remains fragmented and underdeveloped. While the country has general OHS systems in place, hydrogen-specific risks, processes, and standards are not yet integrated into regulation, training infrastructure, or curricula.

This chapter outlines Namibia's most pressing needs and gaps, organised across institutional, regulatory, operational, and educational dimensions. It draws on consultations with stakeholders and builds directly on the benchmarking insights.

**Policy, Regulation, and Strategic Development Gap**

- **Lack of hydrogen-specific legal frameworks:** Current OHS and labour regulations do not reflect the unique hazards of hydrogen, ammonia, and methanol, including flammability, invisible flames, toxicity, and volatility.
- **No enforceable SOPs or standards:** The absence of legal mandates and standardised procedures for PtX processes undermines operational safety.
- **Limited exposure among regulators:** Policymakers and inspectors lack familiarity with hydrogen processes, impeding zoning, inspection, and enforcement.
- **Weak contractor safety frameworks:** Many contractors use generic HSE plans sourced online, without adaptation to local risks such as extreme heat exposure, hazardous roads, or PPE enforcement.
- **Use of unskilled labour in high-risk environments:** High-risk sites often rely on untrained workers following internally developed procedures that are not based on formal hazard analysis, reducing safety and quality.

**Training Infrastructure and Curricula Gaps**

- **Outdated training content**: Existing OHS programmes do not address the chemical, thermal, and confined space risks specific to hydrogen and PtX.
- **Lack of simulation tools:** Institutions lack gas leak simulators, flame detection systems, AR/VR systems, and cryogenic spill training setups.
- **Non-integration of RE–hydrogen interfaces:** Curricula do not reflect hybrid risks involving solar/wind and hydrogen processing infrastructure.
- **Technical and vocational training shortfalls:** TVET programmes remain overly general, with no tailored syllabi for petroleum OHS, offshore safety, or hydrogen process safety. Workers often gain competence only through audits or external partners.

**Shortage of Certified Instructors and Subject Matter Experts**

- **Absence of specialised trainers:** Namibia lacks certified trainers in hydrogen safety and chemical firefighting.
- **Reliance on foreign expertise:** Local subject matter experts are scarce, and safety knowledge is largely imported via foreign consultants.
- **No CPD or Train-the-Trainer programmes:** There are no mechanisms to continuously upgrade instructional capacity or scale hydrogen-related certification.

**Weak Integration into National OHS Systems**

- **OHS protocols omit hydrogen:** National qualifications and frameworks do not include hydrogen-, ammonia-, or methanol-specific content.
- **First responders ill-prepared:** Emergency services lack training in hydrogen-related incidents and simulations.
- **Limited awareness of global standards:** Standards such as NFPA 2, ISO 19880, and IEC 60079 are not applied locally.
- **Misalignment between skills and market needs:** Namibia produces engineering graduates (e.g. in mechatronics), but the local energy sector does not absorb them, resulting in underutilisation of skills.

**Absence of Scenario-Based and Regulatory-Aligned Training**

- **No training for high-risk hydrogen scenarios:** Jet fires, cryogenic spills, and toxic gas dispersion are not covered.
- **Inadequate firefighting models:** Current training is focused on hydrocarbons and does not reflect hydrogen's unique properties (oxygen displacement, invisible flames).
- **No alignment with international certifications:** Training is not benchmarked against ISO, NEBOSH, or IECEx standards.

**Gaps in Certification and International Linkages**

- **No recognition pathways:** Namibia lacks accredited qualifications for hydrogen safety and emergency response.
- **No institutional partnerships with global bodies:** There are no linkages with TÜV, GWO, NFPA, or access to platforms such as HyResponder, HySafe, or IRENA Safety Initiatives.

**Limited Industry–Institutional Collaboration**

- **No joint curriculum development:** Industry players are not engaged in shaping training content.
- **Safety not embedded in permitting:** Training requirements are absent in environmental permits and donor-funded project agreements.

**Institutional and Interagency Gaps**

- **No hydrogen safety strategy at the government level:** Ministries lack hydrogen-specific SOPs, zoning regulations, and preparedness strategies.
- **No local coordination:** Municipalities have no experience with hydrogen emergency drills or cross-agency procedures.

**Workforce Monitoring and Development Deficits**

- **No central skills registry:** Namibia lacks a mechanism to track OHS qualifications, competencies, or CPD milestones.
- **No systematic skills observation:** Supply and demand for PtX safety roles are not monitored.
- **No OHS clauses in donor projects:** Donor-funded programmes lack enforceable safety training KPIs.

**Occupational Health Stressors**

Beyond system-level gaps, workers are exposed to occupational health risks, particularly extreme weather conditions in desert environments. Heat-related illnesses reduce productivity and pose serious safety concerns at construction and operations sites.

**Consequences of Identified Gaps**

- **Elevated operational risk:** higher likelihood of accidents, explosions, and chemical exposure.
- **Weak regulatory compliance:** inability to meet international standards undermines Namibia's export and investment potential.
- **Delayed sector development:** workforce unpreparedness slows infrastructure rollout and commercial readiness.
- **Inadequate emergency readiness:** first responders remain under-equipped to manage high-risk PtX scenarios.

## Conclusion and Recommendations

The above analysis illustrates a comprehensive set of critical gaps that threaten the safe and sustainable development of Namibia's RE and $GH_2$ sectors. Urgent action is required across regulatory reform, training infrastructure development, instructor certification, simulation capabilities, and curriculum modernisation.

Alignment with international best practices and engagement with industry stakeholders will be crucial to ensuring workforce readiness, regulatory compliance, and safety resilience in the face of rapid sectoral growth. Without immediate reforms, gaps in OHS training, regulation, and infrastructure could undermine the safety and sustainability of the sector.

**Addressing these challenges requires:**

- Development of hydrogen- and RE-specific OHS standards and guidelines.
- Modernisation of TVET and higher education curricula to integrate PtX safety.
- Establishment of institutional frameworks to grow local subject matter expertise.
- Implementation of robust contractor safety frameworks tailored to Namibia's conditions.
- Investment in emergency response and simulation infrastructure.
- Benchmarking against countries that have successfully integrated hydrogen safety.
- Active collaboration between regulators, industry, and training providers to build a well-equipped national workforce.

# 2

# RECOMMENDATIONS FOR SHORT COURSES AND TRAINING MEASURES IN THE FIELD OF OCCUPATIONAL HEALTH AND SAFETY

Namibia's growing RE and $GH_2$ sectors hold significant promise for economic transformation, energy independence, and global competitiveness.

Yet the rapid introduction of Power-to-X (PtX) technologies — particularly hydrogen, ammonia, and methanol — has advanced faster than the country's preparedness in Occupational Health and Safety (OHS). Current systems, training infrastructure, emergency readiness, and regulatory enforcement are not yet aligned with the risks these technologies present.

To close these gaps, a targeted programme of short courses and specialised training measures is urgently required. Such programmes must equip Namibia's workforce, institutions, and regulators with the competencies needed to manage hydrogen safely across the full value chain. This includes hazard recognition, firefighting, emergency response, compliance with international standards, and sector-specific safety protocols.

The recommendations set out in this chapter draw on international benchmarks, stakeholder consultations, and the identified needs and gaps within Namibia. They provide a roadmap for building the skills base that will enable safe, efficient, and sustainable development of the hydrogen economy.

## 2.1 General Priority Training Areas and Full List of Possible Short Courses

| Nr | OSH Course | Recommended Duration | Entry Requirements | Priority | Namibian Training Providers (Capacitation Potential) |
|---|---|---|---|---|---|
| 01 | Introduction to Occupational Health and Safety in Renewable Energy | 3 days covering OHS fundamentals, renewable energy hazards, and applicable regulations. | Basic literacy; no prior OSH training needed. | High | NUST, UNAM, VTCs, NIMT |
| 02 | Hydrogen Safety Awareness and Risk Management | 4 days covering hydrogen properties, hazard control, and emergency response. | Technical and engineering background preferred. | High | NUST, UNAM, AIAs |
| 03 | Process Safety Management (PSM) for Hydrogen Production Facilities | 5 days covering PSM frameworks, hazard analysis, and operational control. | Engineering qualification or relevant experience. | High | NUST, UNAM, AIAs |
| 04 | Electrical Safety for Solar, Wind, and Hydrogen Installations | 3 days covering electrical hazards, arc flash prevention, and grounding. | Electrical trade or basic electrical knowledge. | High | NIMT, NUST, NamPower Training Centre |
| 01 | Introduction to Occupational Health and Safety in Renewable Energy | 3 days covering OHS fundamentals, renewable energy hazards, and applicable regulations. | Basic literacy; no prior OSH training needed. | High | NUST, UNAM, VTCs, NIMT |
| 02 | Hydrogen Safety Awareness and Risk Management | 4 days covering hydrogen properties, hazard control, and emergency response. | Technical and engineering background preferred. | High | NUST, UNAM, AIAs |

| Nr | OSH Course | Recommended Duration | Entry Requirements | Priority | Namibian Training Providers (Capacitation Potential) |
|---|---|---|---|---|---|
| 03 | Process Safety Management (PSM) for Hydrogen Production Facilities | 5 days covering PSM frameworks, hazard analysis, and operational control. | Engineering qualification or relevant experience. | High | NUST, UNAM, AIAs |
| 04 | Electrical Safety for Solar, Wind, and Hydrogen Installations | 3 days covering electrical hazards, arc flash prevention, and grounding. | Electrical trade or basic electrical knowledge. | High | NIMT, NUST, NamPower Training Centre |
| 05 | Arc Flash Hazard Awareness and Mitigation | 2 days covering arc flash risks, PPE, and safety practices. | Electrical workers or supervisors. | High | NIMT, NamPower Training Centre |
| 06 | Lockout-Tagout (LOTO) Procedures for Energy Isolation | 2 days covering energy isolation, lockout verification, and documentation. | Maintenance and operations personnel. | High | NIMT, UNAM, AIAs |
| 07 | Working at Heights (Wind Turbines and Solar Arrays) | 3 days covering fall prevention, use of PFAS, and rescue drills. | Physically fit; basic OHS awareness. | High | NIMT, VTCs, Namibia Rescue Academy |
| 08 | Fall Protection and Rope Access Rescue | 3 days covering rope techniques, rescue planning, and emergency scenarios. | Working at heights experience recommended. | High | Namibia Rescue Academy, NIMT |
| 09 | Confined Space Entry and Emergency Rescue (Hydrogen Storage and Processing Units) | 3 days covering entry protocols, atmospheric monitoring, and rescue operations. | Basic OHS training; medical fitness required. | High | NIMT, Namibia Rescue Academy, AIAs |
| 10 | Hazardous Chemicals and Gas Handling (Hydrogen and Ammonia) | 3 days covering chemical hazards, safe handling, and PPE. | Basic OHS knowledge; technical background preferred. | High | NUST, UNAM, AIAs |
| 11 | Cryogenic Safety for Hydrogen and LNG Applications | 2 days covering cryogenic hazards, safe handling, and emergency response. | Technical background preferred. | Medium | UNAM, AIAs |
| 12 | Fire Safety and Explosion Protection in Hydrogen Facilities | 3 days covering fire and explosion risks, prevention, and suppression. | Basic OHS knowledge. | High | Namibia Fire Services, NUST |
| 13 | Emergency Response and Incident Command for Hydrogen Plants | 3 days covering ICS structure, drills, and coordination. | Supervisory or safety management role. | High | Namibia Emergency Management Academy, NUST |
| 14 | Hydrogen Leak Detection and Monitoring Technologies | 2 days covering detection methods, maintenance, and response. | Technical background in instrumentation. | Medium | UNAM, AIAs |
| 15 | Permit-to-Work (PTW) Systems in Renewable Energy Operations | 2 days covering PTW processes, risk assessment, and documentation. | Supervisors, safety officers, technicians. | High | NUST, VTCs |

| Nr | OSH Course | Recommended Duration | Entry Requirements | Priority | Namibian Training Providers (Capacitation Potential) |
|---|---|---|---|---|---|
| 16 | Safe Use of Tools and Machinery in Renewable Energy Installations | 2 days covering safe use, inspections, and hazard control. | Entry-level technicians, artisans. | Medium | NIMT, VTCs |
| 17 | Ergonomics and Manual Handling in Solar and Wind Projects | 1 day covering ergonomic assessment and safe lifting practices. | Open to all workers. | Medium | NUST, VTCs |
| 18 | Environmental, Health, and Safety (EHS) Compliance for Green Hydrogen Projects | 4 days covering EHS regulations, audits, and reporting. | Safety officers, supervisors. | High | NUST, UNAM, AIAs |
| 19 | ISO 45001 Awareness and Implementation for Renewable Energy Projects | 3 days covering OSHMS principles and implementation. | Safety professionals, managers. | High | NUST, UNAM |
| 20 | Occupational Health Surveillance and Monitoring for Hydrogen Industry Workers | 2 days covering worker health monitoring and regulatory compliance. | Occupational health practitioners. | Medium | UNAM, AIAs, MOSHS Training Units |
| 21 | First Aid, CPR, and Emergency Medical Response (Hydrogen Incident Focus) | 2 days covering first aid, CPR, and hydrogen-specific incidents. | Open to all workers. | High | Red Cross Namibia, St John Ambulance |
| 22 | Behaviour-Based Safety (BBS) in Renewable Energy Workplaces | 2 days covering behavioural safety interventions and monitoring. | Supervisors, safety officers. | Medium | NUST, UNAM |
| 23 | Safety Leadership and Culture in Green Hydrogen Operations | 3 days covering leadership methods to strengthen safety culture. | Managers, supervisors. | High | NUST, UNAM |
| 24 | Risk Assessment and Job Safety Analysis (JSA) for Renewable Energy Tasks | 2 days covering hazard identification, risk evaluation, and controls. | Safety officers, supervisors. | High | NUST, UNAM, AIAs |
| 25 | Noise, Vibration, and Occupational Exposure Control in Renewable Energy Facilities | 2 days covering monitoring and control of exposures. | Technicians, safety staff. | Medium | NUST, AIAs |
| 26 | Radiation and Electromagnetic Field (EMF) Safety for Wind Turbine Operations | 2 days covering EMF hazards and protective measures. | Technical background preferred. | Medium | UNAM, AIAs |
| 27 | Contractor Safety Management for Renewable Energy Projects | 2 days covering contractor selection, monitoring, and compliance. | Project managers, safety officers. | High | NUST, UNAM |
| 28 | Transport, Storage, and Handling of Hydrogen Cylinders and Equipment | 2 days covering safe handling, storage, and transport procedures. | Technicians, logistics staff. | High | UNAM, AIAs, NIMT |
| 29 | Waste Management and Environmental Protection in Renewable Energy Operations | 2 days covering hazardous waste handling and environmental compliance. | Open to all workers. | Medium | NUST, UNAM |

| Nr | OSH Course | Recommended Duration | Entry Requirements | Priority | Namibian Training Providers (Capacitation Potential) |
|---|---|---|---|---|---|
| **30** | Incident Investigation and Root Cause Analysis (RCA) for Hydrogen-Related Accidents | 3 days covering investigation techniques and corrective actions. | Supervisors, safety officers. | High | NUST, UNAM |
| **31** | Fire Warden and Emergency Coordinator Training (Hydrogen Plants) | 2 days covering fire coordination, evacuation, and response. | Fire wardens, supervisors. | High | Namibia Fire Services, Namibia Emergency Management Academy |
| 32 | Personal Protective Equipment (PPE) Selection and Use for Hydrogen and Renewable Energy Work | 1 day covering PPE types, standards, and correct usage. | Open to all workers. | High | NUST, VTCs, AIAs |
| 33 | Safe Commissioning, Decommissioning, and Maintenance of Hydrogen Equipment | 3 days covering installation, shutdown, and maintenance safety. | Technical staff, engineers. | High | UNAM, AIAs, NUST |
| 34 | Lifting Operations and Crane Safety in Wind and Solar Projects | 2 days covering lifting plans, rigging safety, and crane operation. | Operators, riggers. | High | NIMT, VTCs |
| 35 | Heat Stress and Cold Stress Management for Outdoor Renewable Energy Workers | 1 day covering hazard prevention and response techniques. | Open to all workers. | Medium | NUST, UNAM |

## 2.2 Prioritisation and Details of the Recommended Upskilling Training Measures and Short Courses

### Most Critical Short-Courses

The following table outlines critical short courses and their associated skills, competencies, and applicable frameworks:

| Short Course | Core Skills and Competencies | Standards and Frameworks |
|---|---|---|
| **Hydrogen Safety Fundamentals** | Chemical properties of hydrogen, hazard recognition, PPE use, OHS signage, basic incident reporting | ISO 19880, NFPA 2 |
| **Cryogenic Hazard Awareness** | Safe cryogenic handling, thermal injury response, pressure relief, cryo-first aid | IEC 60079, OSHA |
| **Hydrogen Transport and Logistics Safety** | ADR labelling, load securing, emergency response, spill containment, route risk assessments | ADR, IATA DGR, GHS |
| **Emergency Response and Incident Command** | ICS structure, inter-agency coordination, drills, crisis communication | NFPA 472, ISO 22320 |
| **Leak Detection and Containment** | Sensor operation, dispersion modelling, preventive maintenance, escalation protocols | IECEx, ISO 26142 |
| **Hydrogen Fire Drills (AR and VR)** | Confined space navigation, flame suppression, hazard recognition, decision-making | GWO, ISO 45001 |
| **OSH Protocols for Hydrogen Infrastructure** | PTW, risk assessment, LOTO, confined space protocols | NEBOSH, OSHA, ISO 45001 |
| **Train-the-Trainer: Hydrogen Safety** | Competency-based training design, facilitation, CPD tracking, evaluation | NQA, IRENA, TÜV Rheinland |

### Upskilling via Modular Short Courses

Targeted Short-Term Interventions

| Course | Target Groups | Purpose |
|---|---|---|
| **Hydrogen Safety Fundamentals** | OHS, Engineers | Introduce PtX hazards and safety frameworks |
| **Cryogenic Hazard Awareness** | Technical staff, HSE | Emergency response and PPE protocols for ammonia and hydrogen |
| **Hydrogen Transport and Logistics Safety** | Drivers, Logistics Officers | Safe ADR and IATA-aligned PtX transport |
| **Emergency Response and Incident Command** | Firefighters, Disaster Teams | Hydrogen-specific inter-agency command and drills |
| **Hydrogen Leak Detection and Containment** | Maintenance and Engineers | Sensor-based gas detection and shutdown protocols |
| **Simulation-Based Fire Drills** | Plant operators, emergency teams | AR and VR emergency scenarios and role play |
| **OSH for Hydrogen Infrastructure** | HSE professionals | Adaptation of ISO 45001 and NEBOSH for GH□ |
| **Training-the-Trainer (ToT)** | Lecturers, TVET Trainers | Build hydrogen safety teaching capacity |

## Medium and Long-Term Qualification Reforms

Qualification Enhancements

| Existing Qualification | Recommended Addition |
|---|---|
| **OHS Diplomas** | Hydrogen safety unit standards (ISO 19880, NFPA 2) |
| **RE Engineering** | PtX integration, arc flash hazards |
| **Fire Services** | Invisible flame firefighting, ammonia response |
| **Logistics and Transport** | Hydrogen ADR protocols, spill management |
| **Environmental Management** | Hydrogen EIA, HAZOP, permitting SOPs |
| **Legal Studies** | $GH_2$ regulation and zoning frameworks |

**New Qualifications to Develop**

National Certificate and Diploma in Hydrogen Safety Technology
Modular courses in:

- PtX Operations and Storage
- Simulation-Based Emergency Drills
- RE-Hydrogen Integration Systems
- Hydrogen Process Engineering (aligned to IECEx CoPC, NEBOSH, GWO)

## Possible Implementation Roadmap

| Phase | Focus | Outcome |
|---|---|---|
| **0–12 months** | Launch short courses, certify trainers, address urgent gaps | Immediate sector readiness |
| **12–24 months** | Embed hydrogen modules into existing curricula | Formal qualification adaptation |
| **24+ months** | Create full hydrogen-focused diplomas and certificates | Long-term workforce sustainability |

## Target Groups and Specialised Skills

- Inspectors and Auditors: Hazard zoning, compliance assessment, inspection protocols
- Firefighters and Emergency Teams: Hydrogen suppression, incident command, confined space rescue
- RE Technicians and Operators: Leak detection, emergency shutdowns, pressurised systems
- OSH and SHEQ Professionals: Hazard analysis, ISO 45001 compliance, SOP documentation
- Legal and Labour Officers: Regulation interpretation, permitting integration
- Policy Analysts and Planners: Infrastructure risk mapping, ESG reporting
- Training Assessors and Instructors: Competency-based design, ISO/NFPA/IEC-aligned assessments

## Possible Institutional and Private Sector Partnerships

The development of hydrogen-ready OHS skills in Namibia requires coordinated partnerships that draw on the strengths of academic institutions, vocational centres, industry stakeholders, regulators, and international partners.

Each plays a distinct role in ensuring that training programmes are relevant, accredited, and aligned with both national and global safety standards.

**Academic and TVET Institutions**

NUST will serve as a technical leader, developing advanced RE and hydrogen modules, piloting curricula, and hosting a Green Hydrogen Centre of Excellence. Its strong engineering and applied research base positions it to connect training with industry demand.

UNAM complements this role by integrating hydrogen into environmental sciences, energy policy, and law, providing the frameworks for regulatory and multidisciplinary training. Collaborations with global universities will strengthen its research and policy focus.

VTCs, (including Windhoek and Valombola) and the NIMT are central to rolling out competency-based courses and practical modules. Upgraded workshops and simulation labs will allow them to deliver safety-critical training in trades such as electrical, plumbing, and welding.

**Industry Stakeholders**

Hyphen Hydrogen Energy, HyIron Green Technologies, and Cleanergy Namibia will act as demonstration partners, offering site-based training, internships, and safety simulations.

NamPower plays a pivotal role in integrating hydrogen and renewable energy systems with grid safety, while private consultancies provide practical safety courses and scenario-based training.

**Regulators and Standards Bodies**

The NTA and NQA ensure that qualifications are NQF-aligned and quality-assured, while the NSI, MoJLR, and the Electricity Control Board (ECB) provide legal, inspection, and safety code harmonisation. Their involvement guarantees that new hydrogen safety training is embedded in regulatory frameworks.

**International Partners**

Namibia must also leverage global expertise. Organisations such as TÜV Rheinland, NEBOSH, IECEx, NFPA, IRENA, GWO, and HySafe bring internationally accredited certification, Train-the-Trainer (ToT) capacity, and curriculum co-design support.

Partnerships with multilateral bodies such as the European Commission, ILO, IRENA, UNIDO, SACREEE, and SASSCAL can further mobilise funding and facilitate knowledge transfer, ensuring Namibia's training system aligns with international standards and best practices.

## Standards and Certification Alignment

All training must be aligned to:

- International Standards: ISO 45001 (OSH Management), IECEx (Explosive Atmospheres), NFPA 2 (Hydrogen Safety), ASME BPVC (Pressure Systems)
- National Standards: Namibia Qualifications Framework (NQF), Namibia Training Authority (NTA) protocols
- Credentialing Tools: Digital badges, modular certification, CPD points, Role-specific certifications

## 2.3 Cross-Cutting Capacity Enablers

Building a hydrogen-ready OHS training ecosystem requires not only the rollout of short courses, but also systemic enablers that ensure quality, consistency, and sustainability. The following cross-cutting measures are proposed to support Namibia in embedding hydrogen safety into its training and regulatory frameworks.

**Curriculum and Standards Development**

A Hydrogen Curriculum Development Committee (HCDC) — led by the NTA, NQA, NSI, and NUST — should be established to oversee the drafting of NQF-aligned hydrogen safety modules. This mechanism would ensure that hydrogen-related unit standards and courses are standardised across institutions and remain aligned with international benchmarks.

**Skills Tracking and Professionalisation**

A Hydrogen Skills Observation (HYSO) platform should be created as a centralised system to track trained professionals, identify emerging skills gaps, and issue CPD points. Employers would be required to report workforce training data, helping regulators and industry bodies monitor competence levels across the sector.

**Trainer Capacity and Certification**

To ensure long-term delivery capability, internationally certified Train-the-Trainer (ToT) programmes should be implemented in partnership with bodies such as TÜV Rheinland, NFPA, and NEBOSH. This would create a pool of accredited local trainers able to deliver hydrogen-specific OHS training at scale.

**Regulatory Integration**

Hydrogen safety certification should be embedded into Namibia's regulatory and investment processes. Certified training should become a requirement for Environmental Impact Assessment (EIA) approvals, donor project compliance, and investment licensing. This integration would establish safety competence as a non-negotiable standard in project development.

**Institutional and Sectoral Upskilling**

- Vocational Training Centres (VTCs and NTA) should introduce hydrogen safety modules into existing trades such as electrical, plumbing, and welding, covering competencies like gas detection, flame suppression, and confined space rescue.
- Universities and TVET providers (NUST, UNAM, NEI) should integrate hydrogen OHS into engineering and public health curricula, deploying micro-credentials and elective modules for rapid uptake.

**Firefighting and Emergency Response**

Specialist providers such as Fastlane, Pegasus, Rubicon, and Royal Safety should expand their offerings to include hydrogen-specific firefighting and emergency response modules. Training should address hydrogen fire behaviour, explosion simulations, and the use of appropriate extinguishing agents such as dry powder.

**OHS Training Providers**

Established OHS training providers, including Nirvana Academy, PS HSE, and SHEQ Eyeq, should adapt their programmes to incorporate hydrogen risk scenarios. This includes training in sensor data interpretation, hydrogen-related SOPs, and emergency coordination.

**Industry-Specific Add-Ons**

Hydrogen safety modules should be embedded in industry-specific training programmes, for example for electricians, safety officers, inspectors, and logistics staff. Providers such as Olyfberg, RHIT, and Safety Compliance can expand their portfolios to address these needs.

**Digital and Simulation-Based Learning**

Providers including Millennium and Pegasus should be supported to roll out VR/AR simulations and hybrid learning models. These technologies can replicate hydrogen fire dynamics, explosion risks, and emergency response scenarios more effectively than traditional classroom training.

# 3

# RECOMMENDATIONS FOR THE USE OF SOFTWARE SOLUTIONS IN HYDROGEN SAFETY TRAINING AND OPERATIONS

Digital tools and software-based systems can play a transformative role in strengthening Namibia's hydrogen safety framework. They provide cost-effective ways to simulate complex hazards, monitor infrastructure in real time, and document compliance with safety standards. Integrating such tools into training and operations will not only raise safety standards but also reduce reliance on expensive physical simulations and foreign expertise.

**Simulation and Risk Analysis Tools**

Namibia should adopt software platforms that allow virtual modelling of hydrogen behaviour, such as leak dispersion, explosion dynamics, and cryogenic spill scenarios. These tools enable safe, low-cost training for emergency responders and technicians.

For example, the National Renewable Energy Laboratory (NREL) in the USA has developed simulation models to assess risks in hydrogen storage and transport, which could be adapted for Namibia's training centres. In Europe, the Fraunhofer Institute (Germany) and TNO (Netherlands) use similar tools to simulate pressure dynamics and leak propagation, providing accurate risk profiles for filling stations and pipelines.

**Monitoring and Early Detection Systems**

Integrating software-linked sensor networks can improve workplace safety by detecting hydrogen leaks, unusual pressure changes, or other anomalies in real time.

These systems typically combine Internet of Things (IoT) devices with AI-supported analysis. For instance, in Germany, advanced monitoring systems are used to automatically flag irregularities in hydrogen facilities, enabling rapid response. Namibia could deploy similar systems in pilot projects at hydrogen plants or training labs, ensuring both worker safety and regulatory compliance.

**Safety Documentation and Compliance Platforms**

Hydrogen projects will increasingly require digital documentation systems to track workforce training, certification, and safety compliance. Software solutions can automate the recording of completed OHS modules, CPD points, and permit-linked safety requirements.

The Dutch HySafe initiative integrates digital safety concepts and compliance tools to harmonise standards across projects. Namibia could replicate this approach by linking safety certification platforms with the Namibia Training Authority (NTA) and environmental permitting processes.

**Practical Recommendations for Namibia**

- Integrate simulation software into TVET and university curricula to train technicians and engineers in hydrogen risk scenarios.
- Deploy monitoring and detection systems in partnership with industry pioneers such as Hyphen Hydrogen, using training sites as demonstration projects.
- Establish a national digital registry of hydrogen safety competencies, managed by NTA/NQA, to track certifications and link them to permitting.
- Partner with international providers (e.g. TÜV Rheinland, NFPA, Fraunhofer, NREL) to adapt existing software to Namibian infrastructure and regulatory needs.
- By embedding software solutions into hydrogen safety planning, Namibia can leapfrog traditional training limitations, reduce operational risks, and align with international best practices - while building its own sustainable capacity.

# 4

# CONCLUSION

Namibia's renewable energy and green hydrogen ambitions create both opportunities and urgent responsibilities. The review of the current training landscape shows that while OHS and firefighting training is well established for traditional industries, it remains largely generic and insufficient for the unique risks posed by hydrogen, ammonia, and other PtX technologies.

The absence of accredited hydrogen-specific qualifications, simulation infrastructure, and recognised subject matter experts presents a significant gap that could undermine safe sector development if not addressed quickly.

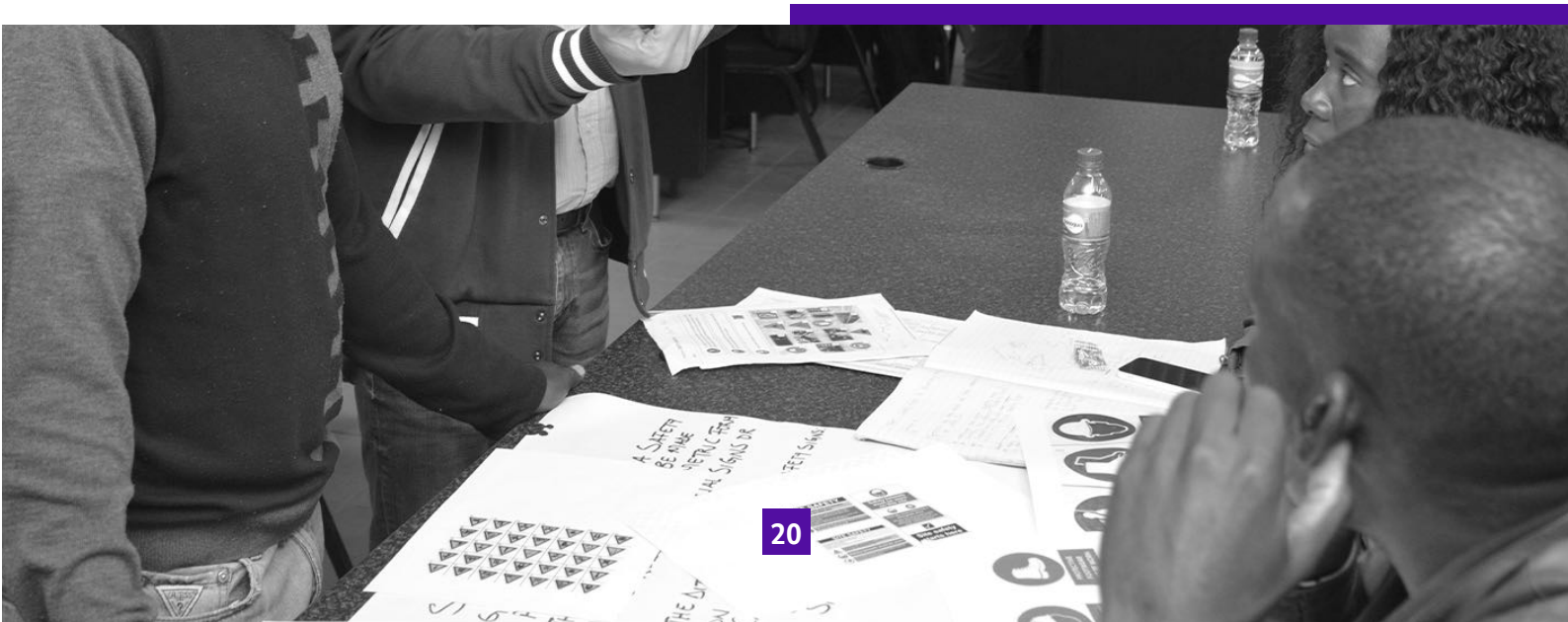
International benchmarking demonstrates that leading hydrogen economies have combined infrastructure roll-out with robust safety frameworks, globally aligned standards, and accredited training systems. Namibia can draw directly on this experience — adapting standards such as ISO 45001, NFPA 2, and IEC 60079, and building partnerships with institutions like TÜV, DNV, NFPA, and HySafe.

These examples show that developing local curricula, certification pathways, and simulation-based training is not optional but essential to competitiveness, investment readiness, and long-term resilience.

To close the gaps, this report recommends a phased but urgent programme of targeted short courses, curriculum reforms, and cross-cutting enablers, supported by strong partnerships between regulators, training providers, industry, and international bodies.

Embedding hydrogen safety into Namibia's OHS framework will require investment in trainers, simulation tools, and digital monitoring systems, alongside regulatory reforms that make certified training a condition for project licensing and compliance.

If implemented decisively, Namibia can build a hydrogen-ready safety culture that safeguards its workforce, attracts investment, and ensures that the country's green energy transition unfolds on a foundation of world-class occupational health and safety.



# 5

# FURTHER INFORMATION

## 5.1 Approved Inspection Authorities and Training Institutions: Focus on Firefighting, OHS (safety culture, fire drills, hazmat, emergency response)

| Institution | Competencies |
|---|---|
| **Africa Fire and Rescue 24** | Specialises in basic and industrial firefighting training, hazardous materials handling, vehicle extrication, high-angle rope rescue, inspection of personal protective equipment (PPE), fire investigation, ladder safety, construction scaffolding, fire hydrant servicing, fire suppression systems, and installation, maintenance, and inspection of lifting equipment and tackles, including load testing of overhead cranes, mobile cranes, and hoists. |
| **Alpha Training and Maintenance CC** | Alpha Training and Maintenance CC offer comprehensive training on basic rigging procedures, operation of heavy machinery including backhoe loaders, articulated dump trucks, skid steer loaders, telescopic boom handlers, rollers, reach stackers, truck-mounted cranes, graders, tracked dozers, mobile elevating platforms, counterbalance lift trucks, 4x4 vehicles (on-road and off-road), advanced driving skills, and mobile cranes. Additional training includes truck and pneumatic systems, maintenance of optic and pneumatic overfill sensors and bottom valves, permits for hot and cold works, gas testing, conveyance of dangerous goods by road, SHE representation, basic firefighting, spill containment, working at height and fall arrest, tank and pipeline inspections, fuel terminal operations, scaffold inspection and handling, confined space entry and SCBA, and advanced rigging during crane operations. |
| **Anoldito Engineers** | Installation, servicing, and maintenance of firefighting equipment; basic and advanced firefighting training; fire safety; reconditioning; fire detection and investigation; fire suppression systems and sprinkler installation; health and occupational safety (risk assessment, accident and incident investigation, safety health and environmental, ISO 18001, safety management training, confined space permit issue, integrated five-star system navigator, scaffold safety, control and inspection); first aid (Class A) training; emergency arrangements at enterprises and industries. |
| **Atlantic Training Institution** | Competencies include First Aid Training (Class A), Emergency Arrangements at Enterprises and Industries, Basic Firefighting Training, Occupational Health and Safety in the Workplace, Occupational Health and Safety Representative and Risk Assessment, Working at Heights, Scaffolding Erector and Inspection, and Confined Space Safety. |
| **Benguella Enterprises (Pty) Ltd** | The institution specialises in hydrostatic pressure testing, requalification of pressure cylinders, visual inspection and certification of firefighting breathing apparatus and fire extinguishers, as well as proof testing and certification of lifting equipment. |
| **Deme Investment cc** | HIRA, Fire Safety, SHE Rep, Working at Heights, Safe Use of PPE, Incident and Accident Investigation and Reporting, Safe Use of Power Tools, Confined Space Entry, Gas Testing, HACCP, Hygiene Training, Handling of Hazardous Chemicals |
| **Eliz Gas Technology** | Specialises in pressure vessel testing and installation services, LPGAS vessel installation and maintenance, safety training for LPGAS fillers and users, and medical and industrial gas installation. |
| **Fast Fire Services** | Fast Fire Services specialises in fire risk assessment and prevention strategies, firefighting and evacuation training, fire appliance reconditioning, detection and suppression training, breathing apparatus training, water sprinkler system training, installation of fire water sprinkler systems according to NFPA and ASIB standards, installation and servicing of fire detection and suppression systems, emergency and evacuation procedures and plans, supply and servicing of used fire appliances, service of water sprinkler systems, fire stopping, pressure testing of fire extinguishers, and maintenance of sprinkler, hydrant and hose reel systems. |

| Institution | Competencies |
|---|---|
| **Global Edge Training Institute** | Competencies include OHS Officer training, OHS (Representative and Supervisor), Scaffold erecting, dismantling and inspection, working at heights, confined spaces, safety management training, risk analysis, evaluation and assessment, OHS compliance, risk management, hazard identification and risk assessment, OHS induction, basic firefighting, and loss prevention. |
| **Independent Schools Edutainment Investment** | The institution provides a wide range of accredited and practical training solutions. Competencies include Train-the-Trainer programmes, Working at Heights, Basic to Advanced Firefighting, Incident and Accident Investigation, HIRA, SHE Rep duties, Risk Assessment Services, and SHEQ Implementation. Technical training includes Drager X-Am gas testing, operating heavy equipment (e.g., CAT 777D, Komatsu HD 785, D375, Liebherr 984, Bell-872G, ADT, F3 Forklift 10 Ton), Advanced Rigging and Hoisting, Legal OSH duties, ISO 45001 Lead Auditor (PR357), Emergency Care Practitioner (Basic), Confined Space Entry, Fire Warden duties, and Hazardous Materials Awareness. |
| **Khoisan Fire and Safety Solutions** | Firefighting equipment installation and servicing, training on firefighting equipment, fire safety risk management consultancy services, and conducting fire drills. |
| **Khomas Fire Risk Consultants** | Basic and Advanced Firefighting; Fire Warden training; Hazardous Materials Awareness and Response; Emergency Care Practitioner (Intermediate); Conducting Fire Investigations; Service agent and Reconditioning of Fire Equipment. |
| **Komesho Skills Development CC** | Komesho Skills Development CC offers extensive competencies including: transportation of dangerous goods by road; general health and safety; basic firefighting techniques; hazard identification and risk assessment; integrated SHEQ internal auditors course; earth moving machines; lifting and rigging work inspection; working at heights and rescue; mobile crane, truck-mounted crane operation; load testing; counter balance lift truck; rigging; train the trainer; hot work; assessor training; scaffolding erection and inspection; overhead crane; safe lifting practices; equipment safeguarding; isolation and lockout; telescopic boom handler; confined spaces procedures; road construction heavy equipment operation; SASOL advanced petrochemical firefighting; operator evaluation; K53 vehicle control system; Education, Training and Development Practices (ETDP) level 4 certification; and more advanced technical and safety courses tailored for industrial and construction sectors. |
| **Nirvana Academy and Investment** | Grader operation and final cut, Roller (10 ton), Tower crane (8 ton), Truck mounted crane (5 ton), Excavator (5 ton), Tractor loader backhoe (1000 kg/500 kg), Articulated dump truck (40 ton), Tipper truck (20 ton), Tractor (all types), Skid-steer loader (1000 kg), Forklift F2 maximum (7 ton/7000 kg), counterbalanced lift truck (15 ton), Pallet lift truck (all types), Front end loader (5 ton), Heavy crane (50 ton), Overhead gantry crane (30 ton), Bulldozer ripper and blade D10, Basic firefighting training, Firefighting 1 and 2, Hazmat Awareness and Transportation of Dangerous Goods, Risk Assessment and HIRA, SHE Representative, Working at Heights and Fall Arrest, Basic Rigging and Slinging, Accident Incident Investigation, Scaffolding Erectors and Inspectors, Advanced Rigging, Safety, Health and Environmental Occupational Management, Construction Health and Safety, Welding, Basic Safety, Health and Safety Procedures. |
| **Okagulu Investment** | Specialises in basic firefighting, hazardous materials (hazmat), training, industrial firefighting, vehicle extrication, inspection of personal protective equipment, fire investigation, installation, maintenance and inspections of lifting equipment and lifting tackles, load testing of overhead cranes, mobile cranes, and hoists. |
| **Okakuyu Fire and Plumbing Services** | Fire extinguisher servicing and repairs, hazard identification, and risk assessment. |
| **Olyfberg Investment** | Olyfberg Investment offers First Aid Class A training, Basic Industrial Firefighting training, CPR for Professionals training, and conducts workplace fire drills and emergency evacuation procedures. |
| **Pegasus Training Practice** | Pegasus Training Practice specialises in comprehensive heavy equipment and safety training, including operation of haul trucks, front-end loaders, excavators, motor graders, tyre dozers, track dozers, water and fuel bowsers, skid steer loaders, tractors, backhoe loaders, compactors, lowbeds, counterbalance lift trucks, telescopic boom handlers, overhead cranes, reach stackers, truck-mounted cranes (5 Ton and 10 Ton), mobile cranes, basic rigging, hot work, basic firefighting, SHE Representative training, hydraulic shovels, diesel trucks, wheel dozers, face shovels, cable reelers, and articulated dump trucks. |
| **Sanprof Safety Namibia** | The institution offers training and services in OSH policy and program development, risk assessments, incident investigations, hazardous materials (Hazmat) training, auditing, and firefighting training. |
| **Shadonai Training Centre** | Provides training in Firefighting Level 1, Hazardous Materials Awareness, HAZMAT and SHE Representative Training, and Risk Assessment Training. |

| Institution | Competencies |
|---|---|
| **Skillset Namibia Training Consultancy** | Basic rigging; D65 Atlas Copco Drill; DM30 Atlas Copco Drill; A30G Volvo Water Sprayer Bowser; A40F Volvo Water Bowser; A30F Volvo Fuel Bowser; Driltech D45K-S Drill; Pit Viper Drill 351 Diesel and Electric; CAT Water Truck 730; Komatsu Haul Truck 730E; Truck Mounted Crane 4.3T; Backhoe Loader; Counter Balance Lift Truck 16T; Carry Deck Crane 3T; Mobile Elevating Platform and Cherry Picker; Front End Loader; Pendant Control Overhead Crane and Gantry Crane 50T; Reach Stacker 45T; Truck Mounted Crane 3.5T; Tractor Loader Backhoe (TLB); Telescopic Boom Handler; Skid Steer Loader; Basic Firefighting; MacLean CS3-085/087/088 Carriers; MacLean Omnia 975 Series Scissor Bolter; Working at Heights; Jacon Transmix 6000 Shotcrete Combo; Epiroc M2C Double Boomer; CAT R1700 LHD Underground Scoop; CAT AD45-B Underground Dump Truck; Hazardous Substances; Pot Carrier; Komatsu 960E Haul Truck; Dispatch Level 1; Mobile elevating platform MEWP; Counter balance lift truck; Front end Loader; Bell B30D, B40D; CAT 740 and Komatsu HM400 articulated dump truck; Komatsu PC800SEmass, PC200; CAT 385C mass and 390D Hydraulic excavator; Komatsu D275, CAT D9R and CAT D10/D11 Track dozer; Bell 872D grader; SHE Rep; Pit Viper 351D and E; CAT 988 front end loader; Hazardous substances HAZMAT; Heavy mining equipment Trainer; OSH Officer (Mining); CAT CS533E, CAT 966, CAT 6020B; Telescopic boom handler; Counter balance lift truck F2; Epiroc FlexiRoc D62; CAT MD6240, 6290, 6200, 5150 and 5125; Truck Mounted Crane (8 Ton); Skip loader (5 Ton); Komatsu Haul Truck 730E; CAT grader 16M/14M/14H; PC5500 Shovel; CAT 7495 Electric Rope Shovel; Basic rigging and Slinging training; Basic firefighting training; SHE Rep training; Perform work at heights training; Transportation of Dangerous Goods; Forklifts (15T) Training |
| **Southey Namibia (Pty) Ltd** | Safe removal, handling, and disposal of asbestos-containing materials; SHE Representative; Scaffolding Inspector; Rope Access and Confined Space; SAMTRAC; Basic Rigging; Basic Firefighting |
| **Symanek Investment** | Load testing overhead crane, Mobile Cranes, Forklifts, Cherry Pickers, Chain Hoist, Chain blocks, Pull Lifts, Car Hoist and Lifting equipment. Basic and Advanced Rigging, Working at Height, Scaffolding Erection and Inspection, Rigging and Lifting Equipment Inspection. Training on: Heavy crane (160T), Telescopic boom handler (21T), Mobile elevating work platform, Counter balanced lift truck (7T), Mobile crane (15T), Pendant controlled overhead crane (25T), Truck mounted cranes (C32), 10T, Lifting tackles inspection, Emergency preparedness, Basic firefighting techniques, SHE REP, General Housekeeping, General Rigging, Training on Lifting Equipment, Load testing and Service of Lifting Equipment, Super Bell Logger, Confined Space, Isolation and Lockout, Reach Stacker, Wharf Side Crane, Skid steer Loader, Tower Crane, Stadler Carrier, Safety Auditor training, HIRA, Infection prevention and control, Health and safety for supervisors, OHSAS 18001:2007 Awareness, Safe Lifting Techniques, and other technical competencies. |
| **West Fire Training and Consulting** | The institution provides specialised training in Firefighting, Transportation of Dangerous Goods, Emergency Evacuation, Supervisor Safety, Fire Protection, and Safety Representative duties. They also offer courses in Fire Technology, Fire Control, Breathing Apparatus usage, Confined Space safety, and are known to provide SAMTRAC-certified training. Their services cater to a wide range of industrial, marine, and construction clients across Namibia. |
| **WestAir Medical Rescue Africa** | Fire and Rescue Tech, Hazmat and Advanced Life Support Training. Includes Fire Fighter 2 Training, Incident Command Control, Rescue Tech, Advanced Life Support, Hazmat, First Aid (Class A), Emergency Arrangement and in Workplaces, Hazard Identification and Risk Assessment, ISO 45001 Awareness, Legal Liability, Fall Protection Planning, Working at Heights, Planned Task Observation, Safety Management, Safety Officer, SHE Rep, Incident Investigation, OSH Induction, and Basic Firefighting. |

## 5.2 Approved Inspection Authorities and Training Institutions: Focus on OHS + Industrial Technical Training (heavy equipment, inspection, certification, radiation safety, ergonomics)

| Institution | Competencies |
|---|---|
| **Advance Driving Academy** | The institution offers comprehensive training including Defensive Driving, Conveyance and Handling of Dangerous Goods, Forklift operation (F1-F5), Tractor Loader Backhoe, Skid Steer Loader, Telescopic Material Handler, Front End Loader, Hiab Truck Mounted Crane, Heavy Vehicle Defensive Driving and 4x4 Training, Overhead Crane operation (pendant and cabin control), Gantry Crane operation (25 Ton + 5 Ton auxiliary), Hydraulic Mobile Crane (20 Ton rough terrain), Basic Rigging and Slinging, and Heavy Vehicle Defensive Driver Training. |
| **All-Safe Training and Consulting** | All-Safe Training and Consulting offers First Aid Training Class A, General Health and Safety Training, and Basic General Safety on Food. Their programmes are designed to equip individuals and organisations with essential safety skills and knowledge. |
| **Atar Industrial Investment** | Competencies include installation and maintenance of boilers and burners, testing of pressure vessels and related equipment, and training of boiler operators on steam and hot water boiler operations. |
| **Awene Safety Consultancy** | Occupational Safety and Health (OHS) Management Systems, Hazard Identification and Risk Assessment (HIRA) Incident and Accident Investigation, Working at Heights, Auditing, Safety Awareness, Basic Emergency Preparedness, Scaffold Erection, Dismantling and Inspection, SHE Representative Training, and Basic Permit to Work Systems. |
| **Axess Namibia** | Competencies include IRATA Level 3 Rope Access, NDT (Non-Destructive Testing), Inspection Supervisor, Welding Inspector, PAUT and TOLD Level 2, Rope Access Technician, NDT testing and inspection, quality control and assurance, rigging, lifting machinery inspection, drill string inspections, and related technical inspection services. |
| **CJ Namib Trading** | Training of Operating: Mobile Hydraulic Crane (500T), Truck Mounted Cranes (7T), Counterbalance Forklift Truck (30T), Telescopic Boom Handler (7T), Skid Steer Loader (2T), Reach Stacker (45T), Working at Heights, Excavator, Overhead Crane, Front End Loader, and Advanced Rigging. |
| **Cynric and Lynn Trading Enterprises** | The institution provides specialised technical and industrial training, including working at heights, confined space safety, and machine operation. Equipment-specific training includes Komatsu Haul Truck 960E, Forklift and Counterbalance Lift Truck, Telehandler MT 1840, CAT 777 D/E, Flexiroc D65, Terex TR100 Haul Truck, XCMG XE490DK Hydraulic Excavator and Hammer, CAT D10 and Komatsu 375 Track Dozers, XCMG LW500 FEL, XCMG GR2605 Motor Grader, Komatsu WD600 Tyre Dozer, CAT 6020 Face Shovel, CAT 395 Hydraulic Excavator, Overhead Crane (25 Ton), Vehicle Mounted Crane, and Compactor Roller operation. |
| **Enzo Trading Enterprises CC** | Competencies include operation and maintenance of Mobile Cranes, Trucks, Forklifts, Front-end Loaders, Wharf Cranes, HIAB Cranes, Tractors, Excavators; Rigging basics, Bobcat, Cherry Picker, Telescopic Handler; plus Scaffolding and Working at Heights Awareness training. |
| **Evelyn Fisch Investment** | Operator training for a wide range of heavy equipment including Counterbalance Lift Truck, Overhead Crane, Pre-operational checks, CAT 769 D Truck, D9R Track Dozer, 777 D Truck, 5130 Excavator, Komatsu HD325 Off-highway Rear Dump Truck, HD 325 Off-highway Water Tanker, PC650 Hydraulic Excavator and Loading Shovel, PC200 Hydraulic Excavator and Rock Breaker, Liebherr R984 Hydraulic Excavator, Atlas COPCO ROC 401 Pneumatic Track Drill, HD 465-7, CAT 375 Excavator, Driltech D25K-S Operator, HD785-5 Operator, WA 800-3 Operator, GD825A-2 Operator, 428D Backhoe Loader, 226B Skid Steer Loader, D9R Tracked Dozer, 950G Front End Loader; also certified as Safety Representative and Workplace Risk Assessment training provider. |
| **Fastlane Emergency Consultancy (FLEC)** | FLEC specialises in providing professional First Aid, CPR, and Safety training. Their services include Accredited General First Aid, Basic First Aid, High-quality CPR-specialised training, and Occupational Health and Safety (OHS) training. They focus on legal liabilities and compliance, hazard identification and risk assessment (HIRA) evaluating identified hazards, implementing control measures, mitigating risks, promoting a culture of safety, and incident investigation and recording. |
| **HFE Human Factors and Ergonomics Namibia CC** | Competencies include ergonomics and human factors consulting and education, along with accident and incident investigations, aimed at improving workplace safety and efficiency. |

| Institution | Competencies |
|---|---|
| **Hüster Machinetool Co Pty Ltd** | Installation, maintenance, and operator training of lifting machines and equipment, including load testing and certification in accordance with national safety standards. |
| **Izzy Cranes CC** | Inspection and load testing certification; maintenance of lifting equipment; machinery and safety-related services on lifting equipment. |
| **JM Engineering Services CC** | The institution specialises in visual inspection, maintenance, hydrostatic pressure testing on pressure vessels and boilers, thickness testing, load testing of lifting equipment and devices, certification of pressure and load tests, boiler training, lagging and cladding, and insulation of LPG receivers, and basic rigging and slinging. |
| **Kharas Training Academy and Investment** | The institution specialises in training for mining earth moving vehicles including Komatsu HD465-7 Rigid Dump Truck, Articulated Dump Trucks (740, A40 and B40), Motor Grader, Front End Loader, Wheel Dozer, Track Type Tractor, Hydraulic Excavator, Skid Steer Loader, Backhoe Loader, Cat models, and related competencies such as isolation of energies, live work, harness use, and working at heights. |
| **Lepala Investment** | Paramedic, Emergency Care Practitioner (Intermediate). |
| **Likius Health and Safety** | Likius Health and Safety specialises in drafting safety policies, conducting risk assessments, providing training on the correct use of personal protective equipment (PPE) performing occupational safety and health (OSH) workplace inspections, and identifying hazards with corresponding risk mitigation strategies. |
| **Logistics Training Services** | Logistics Training Services specialises in driver education, focusing on defensive driving techniques and forklift operation training, aiming to improve road safety and equipment handling efficiency. |
| **Mammoth Rigging Services CC** | The institution specialises in rigging, inspection, and servicing of all lifting equipment, as well as basic and advanced rigging training. |
| **Matcon Investments CC** | Matcon Investments CC specialises in Radiation Safety Training, providing education and consultancy on handling radiation safely in industrial and medical environments, complying with Namibian and international safety regulations. |
| **Namibia Industrial Operators Training** | Competencies include lifting equipment operation and training for reach stackers, terminal trucks, wharf side cranes, mobile cranes, ship and floating dock cranes, forklifts, tractor with trailer, side loader truck, RTG cranes, overhead cranes, graders, bulldozers, front-end loaders, excavators, water trucks, dump trucks, Hiab and truck mounted cranes, backhoes, skid steers, high-raise cherry pickers; training on mobile cranes (160 Ton), heavy trucks, various dump trucks, forklifts, advanced rigging and slinging load, scaffold erection and inspection, working at heights, safety rep, MIG ($CO_2$) welding, confined space entry, and more specialised heavy equipment and safety courses. |
| **Namibian Uranium Association** | The Namibian Uranium Association (NUA) represents the uranium industry in Namibia, focusing on advocacy, sustainable development, and radiation safety management. NUA promotes adherence to environmental standards and provides training in occupational health care and radiation system management. |
| **National Environmental Health Consultants CC** | Competencies include occupational hygiene, monitoring noise, dust, illumination, temperature, stress, ventilation, ergonomics, lead, asbestos, radiation, vibration, and biological hazards. Training includes ISO 9001, 14001, and OHSAS 18001 implementation, OSHE training, and audiometric testing. |
| **ND Diverse Training** | Competencies include Truck Mounted Crane operation, Standard for Equipment Safeguarding, Lifting Tackle Inspection, Hot Work, Mobile Crane operation, Isolation and Lockout, Scaffolding Erection and Inspection, Overhead Crane, Telescopic Boom Handler, Basic Lifting Practices, Counter Balance Lift Truck operation, 908H Wheel Loader, CAT machines, WA380-5 Wheel Loader, 740 Articulated Dump Truck, 226 Skid Steer Loader, Pendant Controlled Overhead Crane, Mobile Elevating Work Platform, 428E Backhoe Loader, 950G Wheel Loader, D9R Track Type Tractors, Mobile Elevated Work Platform C53, Overhead Crane C30, Working at Heights and Rescue, Scaffolding Erector and Fixer and Scaffold Inspector training. |
| **Nenos Enterprises** | Competencies include working at heights, confined spaces, lock out and isolation procedures, and operation of heavy-duty equipment such as the Caterpillar 375. Additional equipment competencies include Excavator, 777D haul truck, D9R track dozer, 824G tyre dozer, 769D water tanker, 14H motor grader, 992K wheel loader, Ingersoll Rand DM45SP drill rig, Atlas Copco ROC L8 drill rig, Komatsu GD675 motor grader, PC2000 face shovel, Hydraulic DTH-Crawler rig, Atlas Copco FlexiROC D65, and Simulator operation. |

| Institution | Competencies |
|---|---|
| **Neodana Investment** | Competencies include Training and Assessing, Drilling Operations, and Drilling in the Oil and Gas sectors, focusing on safety and technical proficiency. |
| **Oasis Capital** | The institution specialises in rigging, inspection and certification of lifting equipment, winch operations, rope splicing, basic rigging training, overhead crane operation, anchor point inspection and certification, and crane certification. |
| **Precision Rigging Operations (Pty) Ltd** | Rigging operations specializing in load testing, certification, cleaning, pressure testing services, ship repairs, mechanical engineering, rubber-lining, and fabrication including tank cleaning and erection. |
| **PS HSE Consulting CC** | Safety, Health, and Environmental Auditor, Training, Database Management, Management System Implementation, and Risk Assessments. |
| **Qinlao Trading** | Competencies include scaffolding inspection, erection, and supervision — covering safety standards and structural integrity. |
| **Raysonic Inspection Test and Certification Namibia CC** | Competencies include Magnetic Particle Testing (Level 2), Ultrasonic Wall Thickness Testing (Level 2), Welding Inspection (Level 2), SAIW Welding and Fabrication Inspector (Level 1), SAIW Basics of Welding Quality Control, SAIW Senior Welding Inspector (Level 2), Ultrasonic Wall Thickness Testing Digital and A-Scan Thickness (Level 2), Radiographic Testing (Level 2), Radiation Safety for Officers, Part 1, and Liquid Penetrant Testing (Level 2). |
| **Rentech Trading CC** | Installation and maintenance of boilers and burners, testing of pressure vessels and equipment, and training of boiler operators in the operation of steam and hot water boilers. |
| **Rhyn Asset Management** | Competencies include inspection of loose lifting gear, offshore and onshore container inspections specifically Closed Cargo Units (CCUs) ensuring compliance with safety standards and regulatory requirements in lifting equipment and container management. |
| **Rhyn Asset Management** | The institution specialises in training for HSE Representative roles, JumpStart to Workplace Safety, Hazard Identification and Risk Assessment (HIRA) Working at Heights, and Workplace Incident Investigations. It also offers Occupational Safety and Health training including workplace risk assessments, audits, inspections, incident investigations, wellness programmes, and SHE induction. |
| **Royal Safety Health and Environmental Consultancy** | The consultancy specialises in basic Occupational Safety and Health (OSH) awareness, incident investigations, OSH training and auditing, policy and program development, risk assessment, emergency preparedness, inspections, legal liability, and compliance. |
| **SHEQ Eyeq Consultancy** | SHEQ Eyeq Consultancy specialises in Hazard Identification, Risk Assessment and Control, Incident Investigation, In-house Awareness Training, Audits and Inspections. Occupational Hygiene competencies include managing physical stressors such as thermal stress, indoor air quality, illumination, noise, vibration, and monitoring hazardous substances like lead, asbestos, and other chemicals, as well as ergonomics. |
| **SHEQ Twenty Four Seven Investments** | The institution specialises in Occupational Health and Safety (OHS) services, including risk assessment, implementation, auditing, and certification, with expertise in OHSAS 18001 and ISO 9001/14001 standards. |
| **Six Thirty - Three Safety Solutions CC** | Competencies include OSH policy and programme development, implementation and investigation, safety legal compliance, risk assessment, incident investigation, OSH supervisor and safety representative training, OSH management training, ISO 45001 implementation, scaffold erection and inspection. |
| **Technical Environment Training CC** | Specialises in High Voltage (HV) and Low Voltage (LV) electrical training and consultancy, including Namibia Electrical Safety Code (NESC) training, operating procedures for reticulation and distribution networks, power system protection, fall arrest system (FAS) and rescue, substation inspections, battery maintenance, safety, health, environment, and quality (SHEQ) awareness, hazard identification and risk assessment (HIRA) and training in electrical measuring instruments. |
| **Wavetec Inspection and Training Services CC** | The institution offers a wide range of competencies including PQR, WPS, WPQR welder qualifications; vacuum testing; dye penetrant inspection Level 2 (PT); magnetic particle inspection Level 2 (MPI); ultrasonic inspection Level 2; radiographic inspection and interpretation Level 2 (RT); visual and quality control inspection; pressure testing inspection; high pressure hydro jet operation; defectoscope inspection Level 3; spectro test, port and sort analysis; and gas free surveys. |

| Institution | Competencies |
|---|---|
| **WN Occupational Safety and Health Academy** | The institution specialises in installation and maintenance of boilers and burners, testing of pressure vessels and equipment, and training of boiler operators in steam and hot water boiler operations. |
| **Zone Safety Academy** | Occupational Safety and Health Training: Risk Assessment, Safety Induction, Occupational Environmental Impact Assessment, Basic Tool Safety training. Earthmoving machine operator training: Articulated dump truck, CAT 740, side steer and bobcat and articulated dump truck, CAT 730 fitted with water tank bowser, front-end loader, CAT 980 and front-end loader, CAT 550, Emergency Care Practitioner (Basic), Operate Excavator, dump truck without restrictions, tractor backhoe loader, 777 Haul dumper, forklift, counterbalance lift truck. |

## 5.3 NUST Offers (Namibia University of Science and Technology)

| Qualification and Course | Level and Format | OSH-Related Focus | Relevance to Renewable Energy and Green Hydrogen Sectors |
|---|---|---|---|
| **Bachelor of Environmental Health Sciences** | Undergraduate degree (4 years) | Occupational hygiene, hazard identification, workplace safety inspections, and risk assessment | Provides foundational OSH expertise applicable to renewable energy sites and hydrogen facilities where health risks exist |
| **Green Hydrogen Summer and Winter School** | Short online workshop (Zoom) | Safety fundamentals for hydrogen generation, storage, transport, and use in fuel-cell technologies | Directly addresses hydrogen-specific hazards, emergency preparedness, and risk control across the green hydrogen value chain |
| **Master of Sustainable Energy Systems (MSc)** | Postgraduate degree (2 years) | Risk management, safe design, commissioning, and operational safety of energy systems | Equips graduates with skills to manage safety in renewable energy projects and hydrogen technology integration |
| **SOLTRAIN+ Renewable Heating and Cooling Workshops** | Short practical training | Safe installation, hazard control, and quality assurance for solar thermal and heat pump systems | Trains technicians to apply safety standards in solar heating infrastructure, supporting renewable energy deployment |
| **Solar PV Trainer Suite, NEI Laboratory Training** | Hands-on laboratory sessions | Practical safety awareness during photovoltaic system installation, testing, and maintenance | Builds competencies in safe PV technology handling, indirectly supporting OSH in renewable energy operations |
| **First Aid Short Course** | Short practical course (3 days) | Emergency response, CPR, trauma care, and workplace incident stabilisation | Enhances emergency preparedness for renewable energy and hydrogen sites where incidents may occur |
| **Occupational Safety and Health (e-learning module)** | Short online course | Introduction to workplace hazards, risk control strategies, and OSH principles | Provides basic OSH knowledge that can be adapted to renewable energy and hydrogen environments |

## 5.4 UNAM Offers (University of Namibia)

| Qualification and Course | Level and Format | OHS Related Focus | Relevance to RE and GH□ |
|---|---|---|---|
| **Postgraduate Diploma in Occupational Safety and Health** | Postgraduate diploma (planned and delivered via Department) | Hazard identification, occupational hygiene and toxicology, safety management systems, emergency preparedness, risk management, legal aspects | Provides foundational OHS competence for roles in emerging energy sectors, including hydrogen and renewable projects (supports local OSH course delivery) |
| **Master of Science in Renewable Energy Engineering (in development)** | Proposed MSc (coming soon) | Safety in renewable energy systems, integration of OHS in solar PV and wind project design and operation | Aligns directly with safety requirements for renewable and hydrogen infrastructure and PtX systems |
| **Short courses via UNAM–EIF Climate Change Programme** | Certificate (NQA Level 8, short course) | Climate change mitigation and adaptation, project management, policy—including safety planning implications | Broad environmental risk awareness applicable for risk assessments in renewable and hydrogen projects |
| **Hydrogen safety and materials science modules (through NGHRI)** | Workshop and Module (NGHRI training offerings) | Training on hydrogen safety protocols (handling, leak prevention, materials compatibility), emergency response | Directly relevant to PtX and hydrogen value chain safety training modules |
| **Participation in international training and PhD research in Green Hydrogen (Germany collaboration)** | Doctoral research and overseas training | Advanced hydrogen safety research, operational standards, experimental safety protocols | Builds in-country capacity; OSH relevance through PhD-level research and exposure |

# 6

# LITERATURE AND DOCUMENTS USED

**Sources**:

Management software


- https://www.secova.de/en/software/sam-ehs-base-system/?_gl=1*nczmy6*_up*MQ..*_gs*MQ..&gclid=Cj0KCQjw64jDBhDXARIsABkk8J4xv3nCKKYegVZwLs9LUY13JFN7d2yru9JmDgah8MirhN5k6oQqVmgaAg-aEALw_wcB&gbraid=0AAAAAD9IpLUgDmKVCP1NuXhKofqbEsZpk
- https://erasmus-plus.ec.europa.eu/
- https://solutions.hse.gov.uk/safe-net-zero/hydrogen-safety
- https://h2tools.org/bestpractices/laboratory-safety/laboratory-operations/hydrogen-hazards
- https://hysafe.info/
- https://www.nrel.gov/hydrogen/safety-codes-standards
- https://www.catf.us/resource/regulatory-framework-hydrogen-us/
- https://psaafrica.co.za/hydrogen-safety/
- https://www.tuvsud.com/en-id/country/south-africa/hydrogen/hydrogen-safety-training-program
- https://energytraining.ae/training-expertise/hydrogen-industry/oslo-norway (Norway)
- https://hydrogeninstitute.com/hydrogen-training/hydrogen-training-courses/ (USA)
- https://www.shirleyparsons.com/de/netherlands (Netherlands)
- https://www.hsl.gov.uk/hse-health-and-safety-training-courses/hydrogen-the-fundamentals (UK)
- https://www.gov.uk/ (UK)
- https://www.hse.si/en/hse-co-signs-the-consortium-agreement-to-establish-a-hydrogen-ecosystem-from-low-carbon-sources/ (Slovenia)