



HyCoRA – Hydrogen Contaminant Risk Assessment Grant agreement no: 621223

Deliverable 5.7 List of hydrogen QA recommendations

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Summary This deliverable provides a list of recommendation for quality assurance (QA) of hydrogen fuel for PEM fuel cells, based on the results from and communications within HyCoRA project.	
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1. Objective of this deliverable

The objective of this deliverable is to list recommendations for quality assurance (QA) protocols for instrumentation and methods. These recommendations are based on the risk analysis (WP4), on the discussions on the workshops and with SDOs, as well as on the project results on sampling and analysis (WP2 and WP3) and fuel cell measurements (WP1).

2. List of hydrogen QA recommendations

This deliverable first lists the main HyCoRA project results that could and should be taken into consideration in hydrogen fuel QA, chapter 2.1, and then gives overall recommendations in two lists: one for hydrogen fuel suppliers, chapter 2.2, and one for hydrogen refuelling station (HRS) operators, chapter 2.3.

A distinction is made between off-site hydrogen production with subsequent transport, e.g. by tube trailers or through pipes of the produced hydrogen to the hydrogen refuelling station (HRS) and on-site hydrogen production at the HRS.

2.1 HyCoRA findings for hydrogen QA

For the QA of automotive hydrogen fuel, HyCoRA:

- has shown, that there is a clear difference between the contaminant measurement results when conventional fuel cell test station and “miniature automotive system” are used. This highlights the **importance of performing measurements with similar components and conditions** as in real **automotive systems**.
- has shown, that the HCHO and HCOOH limits in hydrogen fuel standard ISO 14687 are currently too tight (0.01 and 0.2 ppm, respectively), and could be relaxed
- results **does not** indicate the fuel quality correlates with **feedstock and commissioning date**.
- results indicate that **N₂ is the main fuel violator**, thus HRS purging (assuming not from production) with H₂ must be done followed by control of N₂ level.
- common fuel violations have been N₂, O₂.
- results have only detected CH₂Cl₂ and C₄Cl₄F₆ from halogenates.
- results have shown a predominance for H₂S, COS and CS₂ for sulfur species.
- has established standardized sampling for quality control (QC) (19880-1 Annex I).

2.2 Hydrogen fuel suppliers

- Perform and repeat when a change occurs (new equipment / instrumentation, repair, process parameter, control strategy, etc.) an assessment of potential contaminant risk in the production process of hydrogen used, any applicable intermediate hydrogen storage and means of hydrogen transport to HRS site
- Set up and regularly revise hydrogen QA plan to establish and maintain QA procedures for production process and transport means including process control and

maintenance, contaminant removal, gas analysis for relevant contaminant species, sampling location and interval according to supplier agreement

- For hydrogen production by steam methane reforming (SMR), monitor CO concentration in produced hydrogen and take appropriate action when a specified level (e.g. 0.05 vppm) is exceeded
- Perform periodic maintenance of process installation and transport means
- Take appropriate and immediate action after any event or result of analysis likely to have a bearing on hydrogen quality, including prompt information to customer
- Keep record of relevant documents of installation, QA plan, performed maintenance and analysis as well as occurrences of events
- Identify potential contaminants in the production process and evaluate their amounts (concentrations) as a function of the process parameter and track the main contaminants as canary species where possible online while regularly monitoring any deviations from set limit(s)
- Pay due attention to chlorine and sulphur species by determining the probability of their presence in the produced hydrogen at concentrations higher than recommended in the specification, and take appropriate intervention in order not to exceed these values

2.3 Hydrogen refuelling station operators

- Perform and repeat, in case of any relevant change occurs (new equipment or instrumentation, repair, process parameter, control strategy, etc.), an assessment of potential contaminant risk in the production process of hydrogen or supply of hydrogen and storage up to nozzle delivery to vehicle
- Set up and regularly revise hydrogen QA plan to establish and maintain QA procedures for hydrogen production or supply, storage, hydrogen quality analysis and nozzle delivery of hydrogen to vehicle including emergency measures
- Perform regular maintenance of production equipment, storage and dispatch devices including purge upon repair action as well as clean-up of HRS components in case of established or potential contamination
- Ensure that any changes made to the HRS, including maintenance performed in the supply and storage of hydrogen, does not affect the quality of the delivered hydrogen at the nozzle to be out of specification
- Ensure online measurement technique and apparatus for hydrogen fuel contaminant detection (e.g. limiting / canary species: for water electrolysis O₂, N₂, H₂O) is regularly maintained and calibrated according to established QA plan at representative HRS location
- For on-site production of hydrogen by SMR and small scale storage, monitor online CO concentration in produced hydrogen and take immediate and appropriate action when a specified level (e.g. 0.05 vppm) is exceeded



- Identify potential contaminants in the production process, evaluate their concentrations as a function of the station operation parameters, and track online the main contaminants, as canary species, where possible and regularly monitoring any deviations from set limit(s)
- Pay due attention to chlorine and sulphur species by determining the probability of their presence in the produced hydrogen at concentration higher than recommended in the specification, and take appropriate intervention in order not to exceed these values
- Set limit and ensure proper and timely activation of nozzle stoppage when hydrogen fuel quality is out specification
- Timely inform client of any risk on quality of hydrogen dispatched from HRS nozzle