



PROTON VENTURES

PGS-12 NH₃ Storage and Handling:
code development methodology
for a renewable future



AMMONIA ENERGY
ASSOCIATION

Speaker

Stefano de Cillis CTO

Proton Ventures Bv.

Empowering green ammonia **and energy solutions**

July 22, 2022

Proton Ventures NH₃ (energy) storage & handling

- Refrigerated storage tanks (largest of Europe)
- Main & holding compressors
- Marine & railcar (un)loading facilities
- Railcar loading facility
- Utilities



Terminal business references

- 2x30.000 Metric ton Estonia (2009)
- 10.000 Metric ton Bulgaria (2013)
- 2x30.000 Metric ton Estonia (2019)
- 12.000 Metric ton Bulgaria (2021)

The background of the slide is a vibrant blue color, densely populated with numerous speech bubbles of various colors including red, yellow, pink, and white. Each speech bubble contains a large, dark blue question mark, creating a visual theme of inquiry and questions.

Why is PGS-12 discussed now in the netherlands?

EU/Port of Rotterdam Hydrogen Ambitions

- EU ambition to import 10MTPA of Renewable Hydrogen by 2030
- Import of 20MTPA by 2050 through the Port of Rotterdam
- Supports **Zero Emissions Maritime Buyers Alliance (ZEMBA)** , an initiative, [recently launched](#) for the transport of 600,000 twenty foot containers (TEU) on ocean-going container vessels powered by zero-emissions fuels (green methanol and ammonia)
- Dutch national hydrogen network (planned 1200km in length) starting in the Maasvlakte to Pernis (Rotterdam Harbour)
- Ammonia and Methanol as a vehicle to achieve targets
- Studies to commence on an ammonia pipeline from Rotterdam to Germany (+500km)





Industry Response to the EU/Port of Rotterdam's H2 objectives

permit requests

- **Ammonia Terminals 10** (Rotterdam 8, Vlissingen 2)

Tank sizes range from 20kT to 60kT

- **Ammonia Crackers**

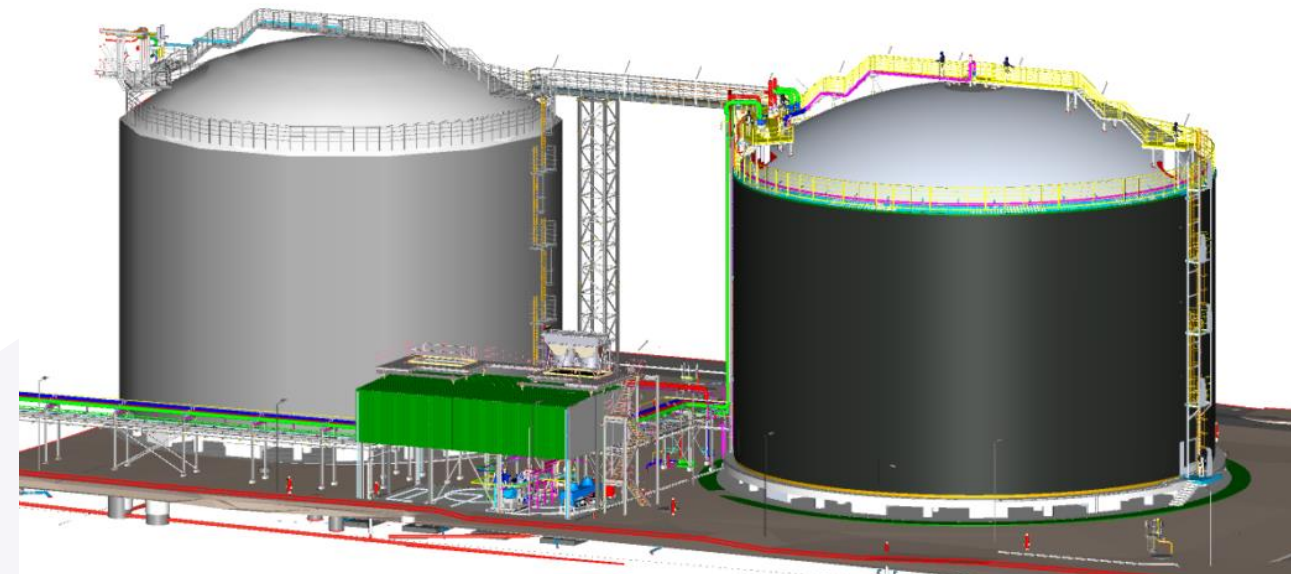
All Terminals have plans for a cracker.

international project to supply rotterdam harbour with ammonia

- Transatlantic Clean Hydrogen Trade Coalition (**H2TC**) to import **3MTPA** in green ammonia and methanol in 2026 from USA.
- TransHydrogen Alliance (**THA**) to import **2,2MTPA** of ammonia from Brazil first 400kTPA by 2026
- **Uniper** to import **4MTPA** of ammonia from USA first 100kTPA by 2026
- **OCI** to import **160kTPA** of ammonia from USA by 2026
- Many more Blue and green ammonia projects worldwide

What is the PGS-12?

- PGS (Publications on Hazardous Substances) regulations and guidelines for the storage and handling of dangerous products.
- PGS-12 – Ammonia Storage and Handling guidelines
- In the Netherlands it is a legal requirement
- Adopted in Estonia and Bulgaria
- Ammonia design specific and one of the better codes for ammonia storage facilities
- Used by Proton for all designed terminals



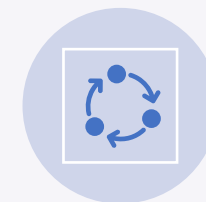
Current PGS-12... Is it future proof?



Does the PGS-12 cover the large quantities stored and handled for the energy transition?



Is the current industrial QRA risk profile of ammonia installation acceptable?



Are group risk and domino effects considered for permitting?



Will tanks and storage facilities limit the development of other new industries, such as methanol/Ethanol storage or Hydrogen Cracking?



Does the PGS-12 ensure NEW Energy players inexperienced with ammonia can operate safely?

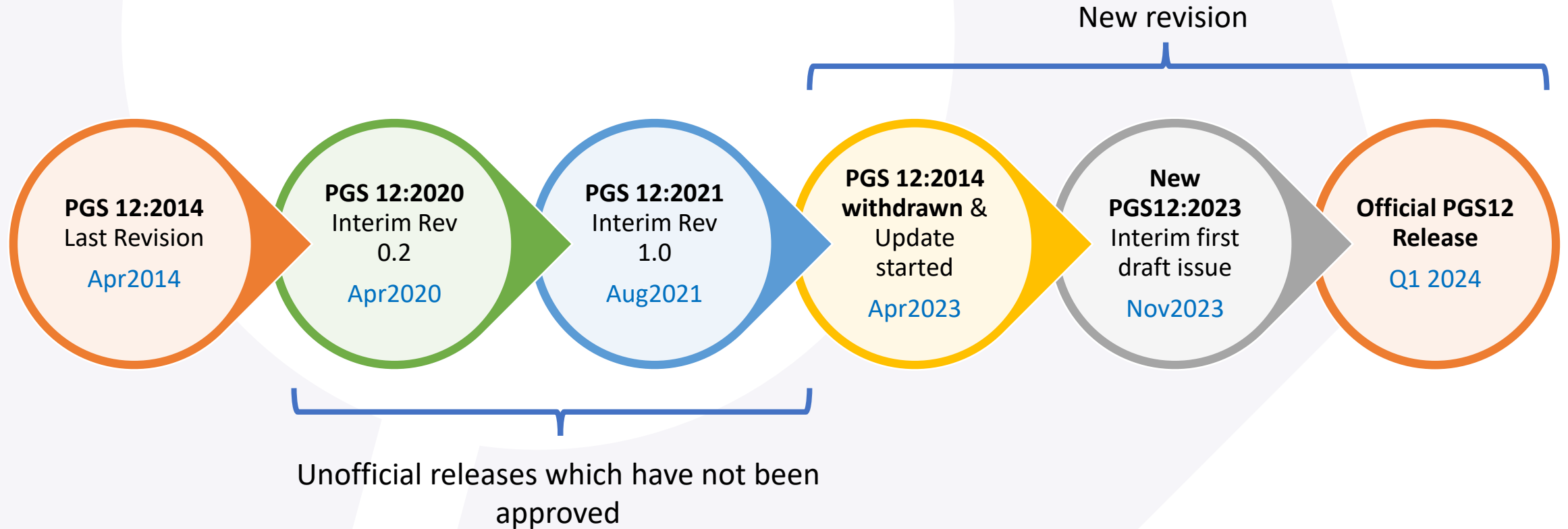
DCMR (*The Environmental Protection Authority of Rijnmond, the Netherlands*) response:

A clear 'NO'!

The current PGS-12:2014 allows for too many risks & uncertainty in design and operations.

10 projects have been put on **HOLD** allow for the PGS-12 to be upgraded.

PGS-12 Timeline



PGS-12 Work Group

Stakeholder representing different parts of the ammonia industry and society, each providing their own perspective and experience in ammonia handling, safety and design.



- **DCMR** Environmental Protection Agency of Rijnmond, and project permit authority over Zuid-Holland and Zeeland
- **Brandweer Rotterdam** Emergency Response – Fire department in Europoort
- **Rijkswaterstaat** Responsible for the Dutch infrastructure project, e.g. roads and waterways
- company representatives** operating in the Netherlands and with ammonia experience
- **OCI / Yara / Vopak**
- **Proton Ventures** engineering bureau
- **ARBO** labour authority - from the sideline

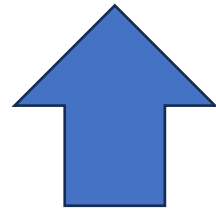
PGS-12 Industry based open forum

Setup by **VOTOB** (vereniging van nederlandse tankopslagbedrijven)

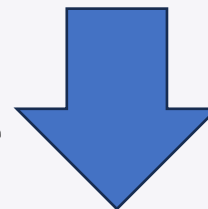
Not directly involved in the PGS-12 work group

Industry OPEN FORUM

Provides an opportunity for industry to express concerns and individual opinions.



Information exchange



PGS-12 WORK GROUP

These concerns/opinions/issues are brought back into the discussion of the PGS-12 work group in a consolidated manner

Code development methodology

Polder Approach. Consensus is required from all stakeholders.

1. Define the key risks, issues and concerns.
2. Advantages and disadvantages of designs
3. Looking at other industries for improved BAT, e.g. LNG and LPG storage
4. defining new BAT technologies as a group
5. Conflict resolution of non consensus items (smaller work groups on tackling specific topics and disputes)
6. Consensus, or adjourn proceeding with 'homework' until the following meeting, leading to a slow changing of viewpoints and opinions.

Tools

- Bow tie based risk assessment (Risk Prevention & Mitigation)
- QRA
- Dispersion Studies
- Site Visits and Case Studies

Can we adopt the PGS-12 Methodology Globally?

- Consideration
 1. Challenges with scale (The Netherlands is a bubble, in comparison to the world) and local stakeholders and societies could be underrepresented.
 2. PGS-12 is not an independent document. It is an integral part of other PGS documents PGS-3, PGS-13, PGS-29, etc, as well as other dutch permitting legislation, making it challenging to introduce into other countries.
- Will it be a benchmark code for other countries to adopt?

Definitely! It will contain thoughtout BAT technology

- Can the methodology be used in writing other Ammonia codes and standards?

Depends on the social consequences

Ammonia Codes should be centralised similar to the API, and be focused solely on the ammonia industry, with its own standards, materials and procedures.



PROTON VENTURES

Thank you.
Questions?

+31-10 42 67 275

info@protonventures.com

www.protonventures.com

Empowering green ammonia **and energy solutions**