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ZERO REGIO



Lombardia & Rhein-Main towards Zero Emission:
Development and Demonstration of Infrastructure
Systems for Hydrogen as an Alternative Motor Fuel
(Relation to RCS)

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A demonstration project

- 16 partners - Industry , public authorities and univs.
- IP, Project start – Nov. 15, 2004; Duration 5 years
- Demonstration sites –
 - Rhein-Main, Germany:
 - Hydrogen as a by-product of a chemical plant
 - Fleet of F-Cell Class A from DaimlerChrysler
 - Lombardia, Italy:
 - On-site hydrogen production
 - Fleet of Panda FC-cars from Fiat

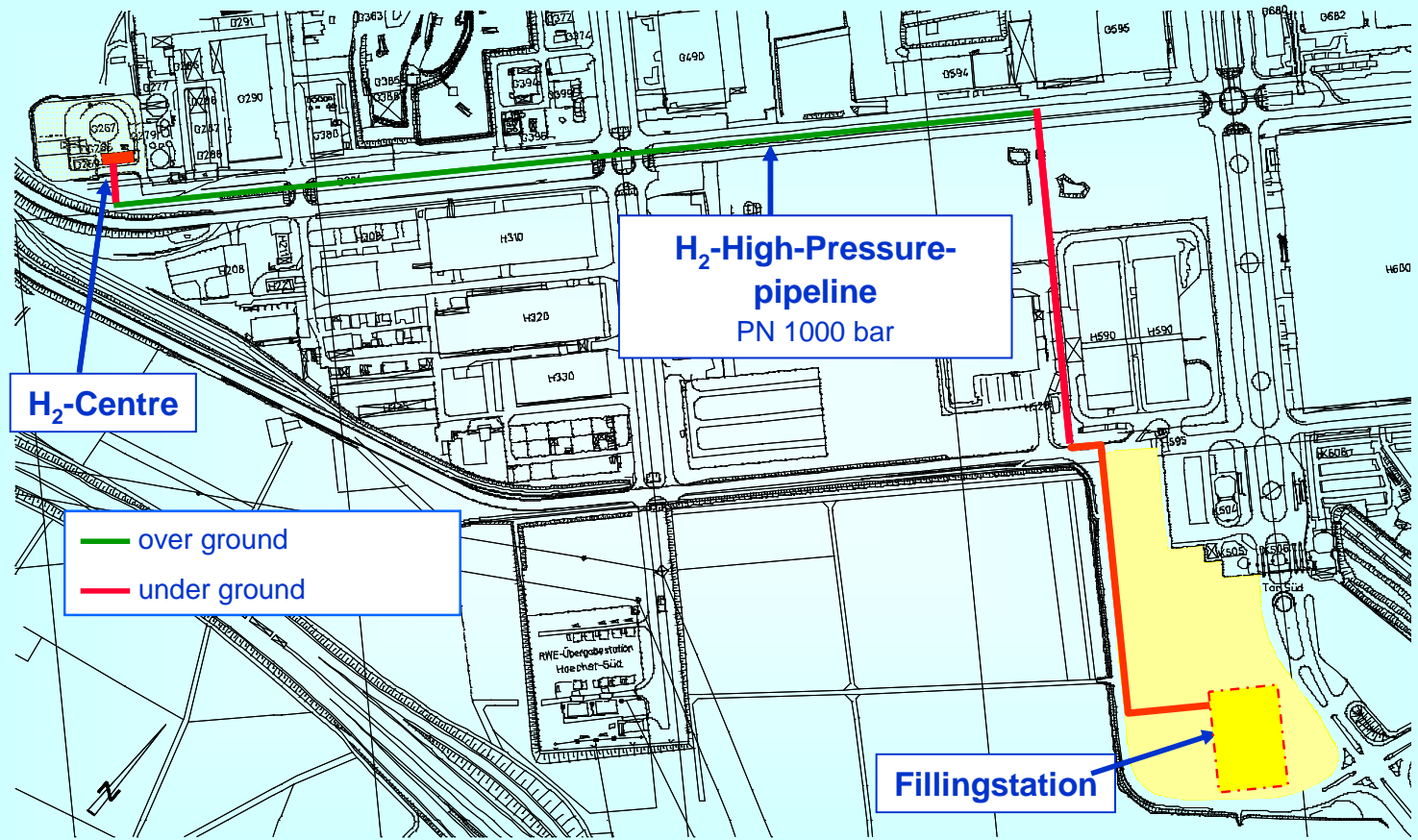




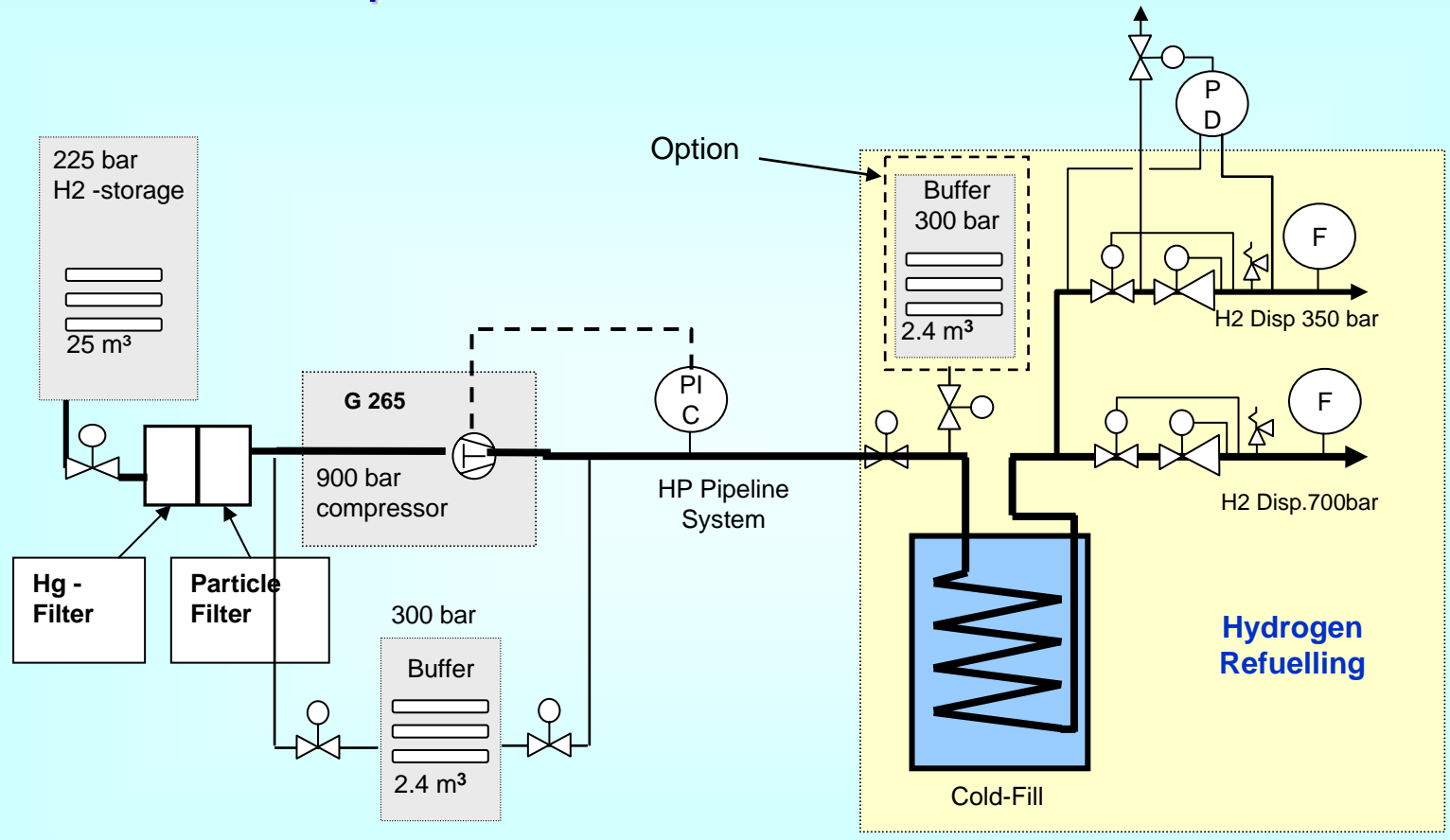
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Lay out HP Pipeline in Höchst



Compression & Distribution Scheme





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Building & Operating Approvals in Germany

- One approval relates to compressor, pipeline and the concrete housing for buffer storage - §16 BImSchG
- Received in June 2006, approval time 10 months, Extension of the existing H₂ center (no operating permit reqd.)
- Different authorities & regulations used
 - City & district fire directions
 - City & district health directions
 - etc.
- Second approval for building the conventional service station based on VdTÜV 510 and TRG 400-405 – obtained in 10 weeks
- Third for operating each filling unit based on §13 BetrSichV and TRG730 – 4 months after evaluators report – too long !!
- Many queries from authorities due to lack of information



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RCS – High pressure pipeline

- 1.7 km, 1.4462 SS, Di=18mm, Do=33.7mm, 300-1000 bar
 - One of its kind, requires standards for design & construction
 - AD 2000 used for design backed by verification
 - Computation (FEM) of normal stresses in the pipe.
 - Original pipe with ca.10 welds will be subjected to up to 2 million pressure alterations bet. 300 & 1000 bar
 - Experiments with tensile load alterations in presence of H₂ up to 120 bar – embrittlement tests
 - Qualification of the welding procedure for 1.4462 SS specimens
 - Certification of the additional welding material according to DIN EN ISO 10204.
- verified standards & norms for such applications



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Some Additional Safety Considerations

- Safety concept was checked once again independently
- No clear regulations for neighbouring buildings
- All the relevant regulations were consulted incl. those from EIGA, IGC, NASA and NFPA
- Underground part of the pipeline will have
 - a minimum distance of 7 m from the next building H 500 claim of the owner
 - no detachable joints/connections near this building
- The pipeline will undergo a pressure-test every 24 hrs. with H₂
- Pressure gradients will be monitored during operation
 - better/clearer standards for safety aspects



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RCS matters in Italy

- Situation different and more difficult as regards approval
- One approval application (single authorisation act) for all systems
- No precedence, no regulations (draft version for H₂ distribution plants)
 - No indication of harmonisation!
- Local fire brigade very important (& authoritative)
- Very detailed risk & safety analyses were performed
- Approval was performed in two steps
- Approval time for the conventional part - 6 months
- Approval for hydrogen production, storage and distribution system about an year
- Need for communication between authorities at the two sites



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Concluding remarks

- HP transport of hydrogen – a novel item in Zero Regio
- Work performed has a potential of better norms
- There is need for
 - Specific standards & regulations for hydrogen filling facilities
 - Quicker approval formalities
 - Industrial standards are used at present. For public filling stations the procedures can be optimised
 - Education of regulating authorities !
- Large differences have been observed between Germany and Italy as regards approvals at the two sites
- EU wide harmonisation ?



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Thank You