

Progress in Safety Distance Determination for Hydrogen Installations

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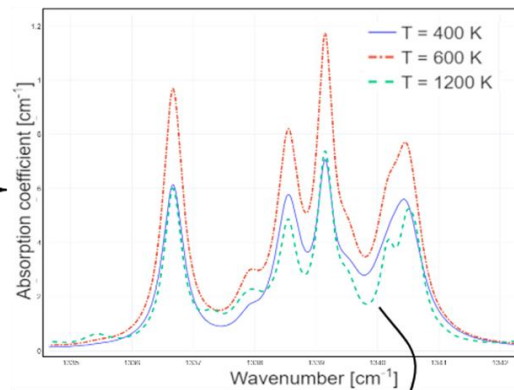
What is a safety distance?



Radiation



Molecular spectroscopic database

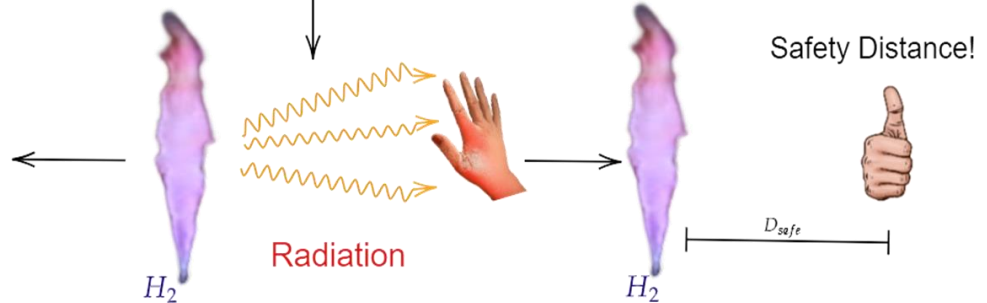


Using the HITRAN database to model spectral profiles and quantify the emitted heat flux \dot{q}''_{emi}

$$\dot{q}''_{emi} = \epsilon \cdot \sigma T^4$$

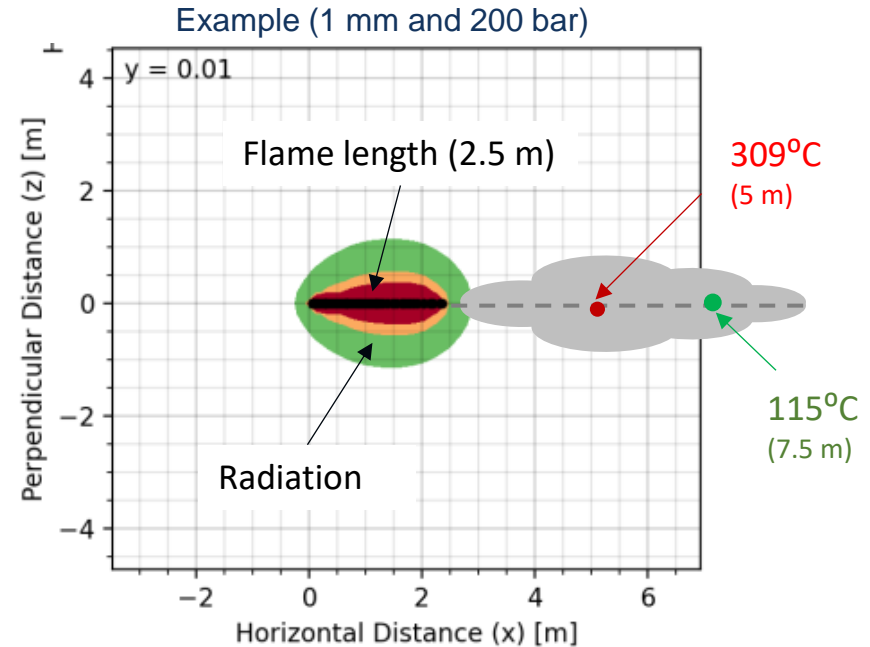
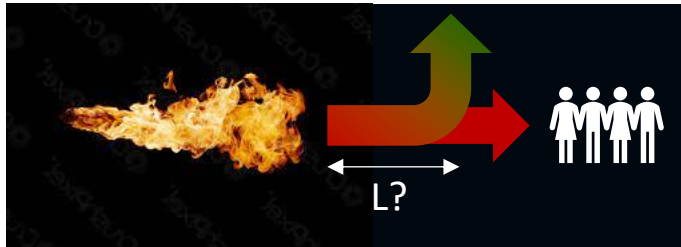
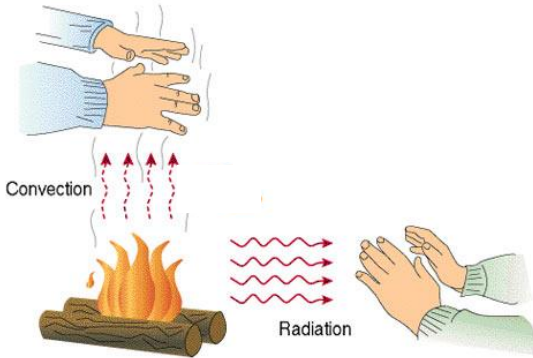
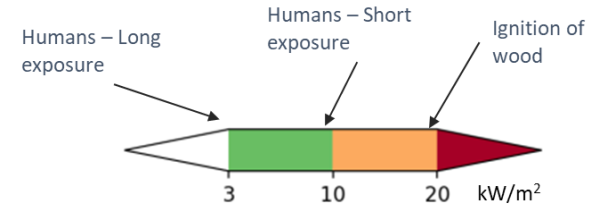


Data collected from experiments

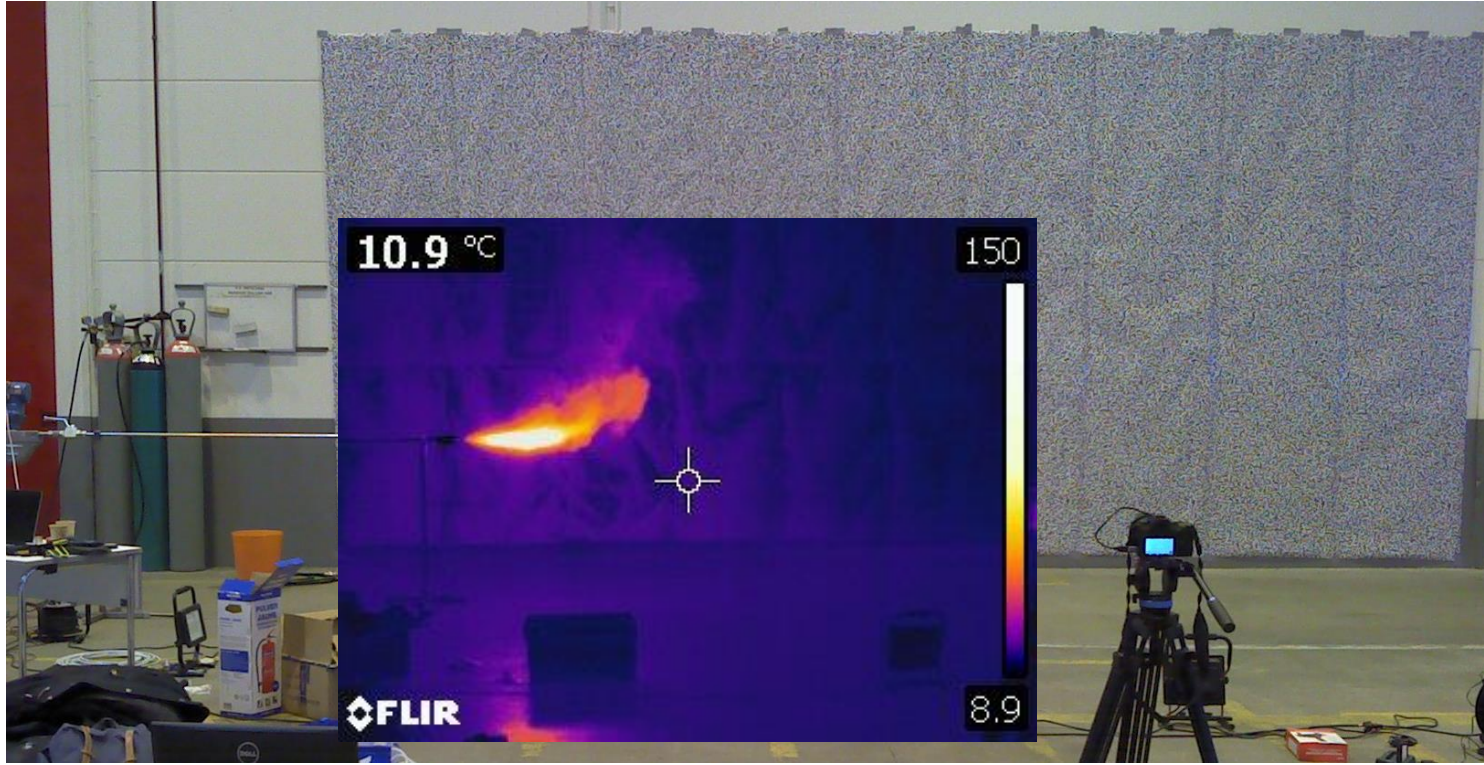


Determine the safety distance D_{safe}

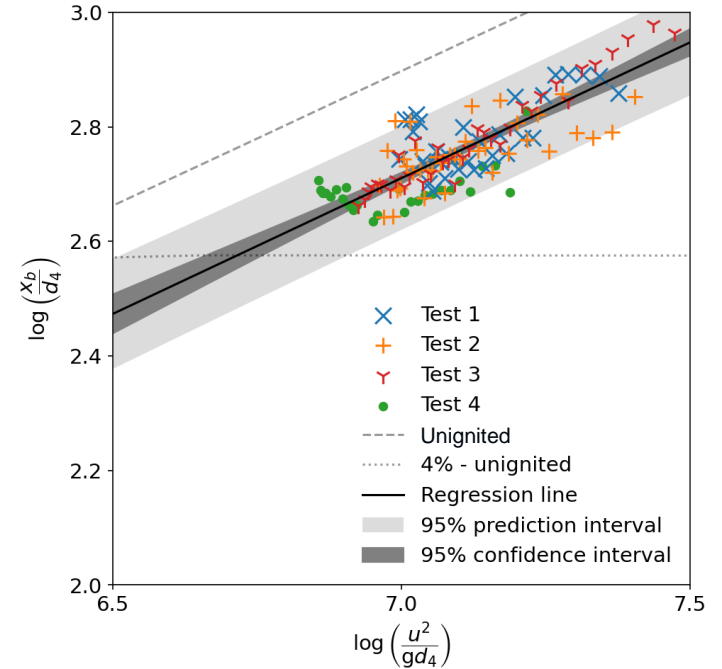
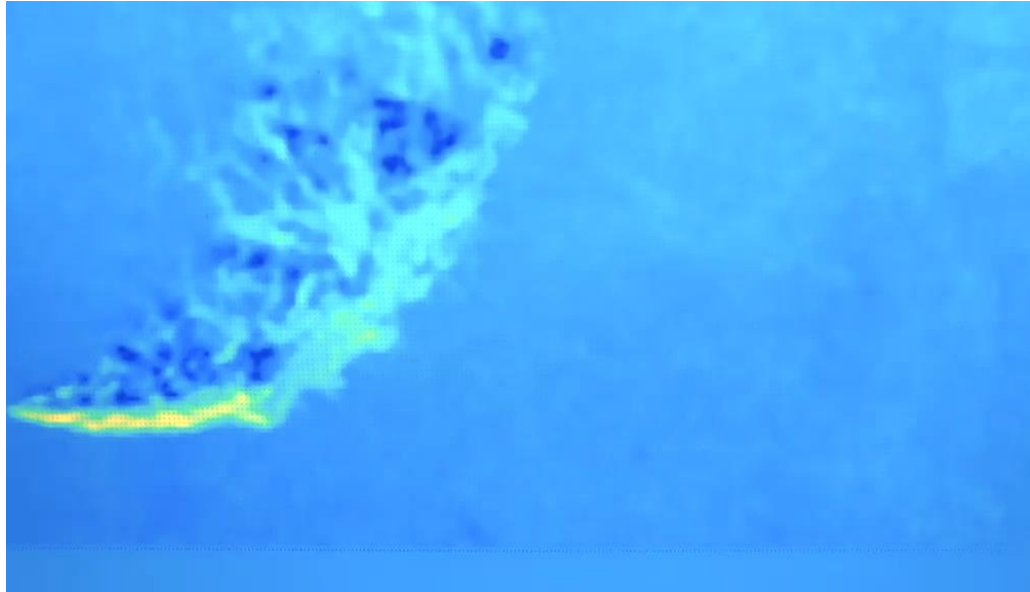
Radiation vs Gas temperature (Convection)



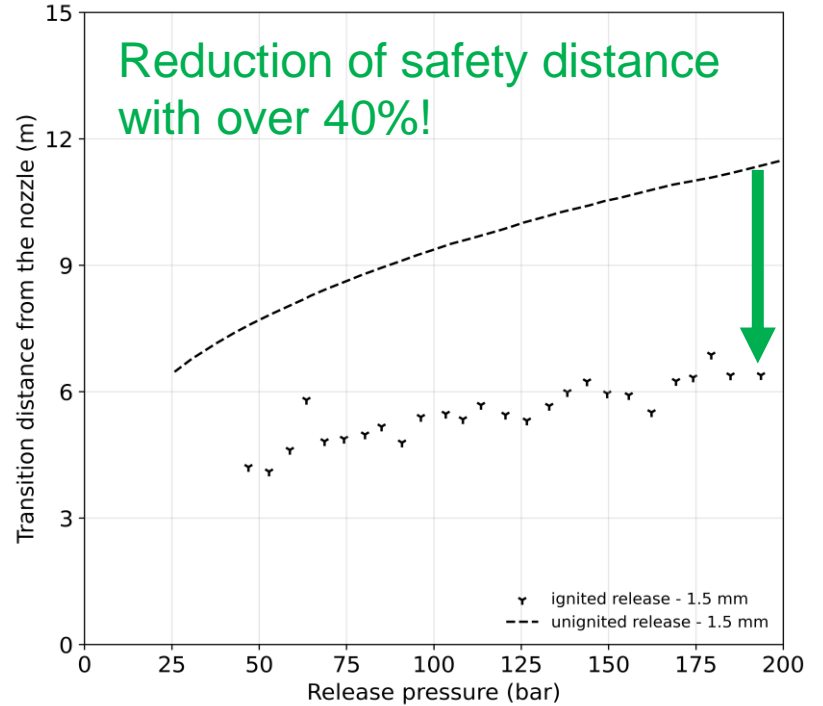
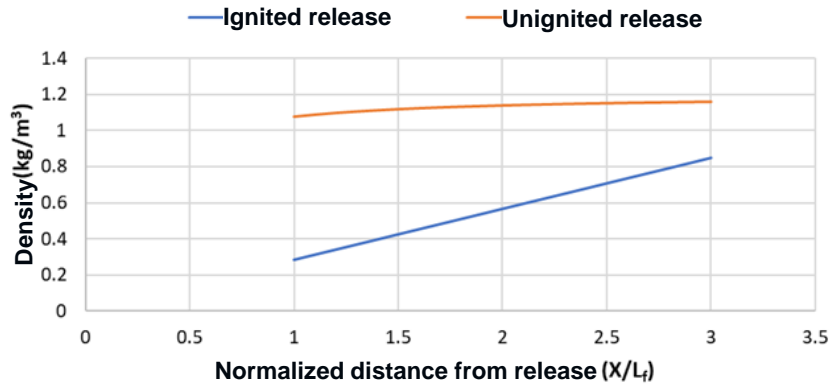
Experiments within H2SIPP



After Post-processing

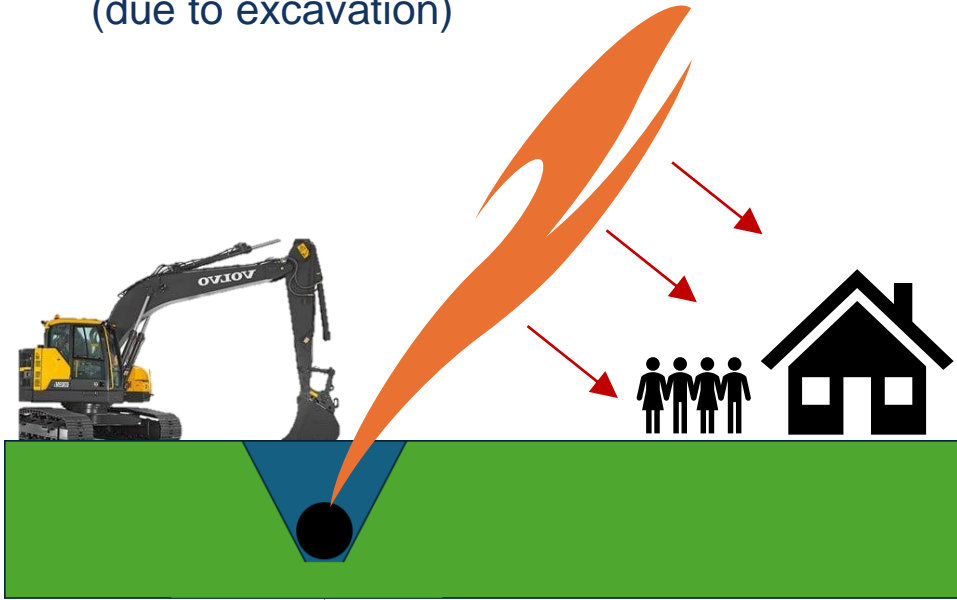


Old and new approach

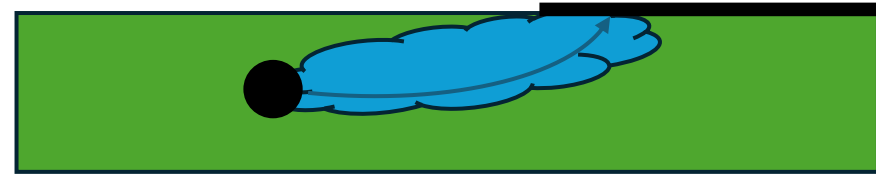


Safety distance for hydrogen pipelines – Two scenarios

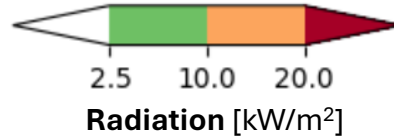
Hole in pipe pit
(due to excavation)






Hole under ground
(due to ground movement or corrosion)

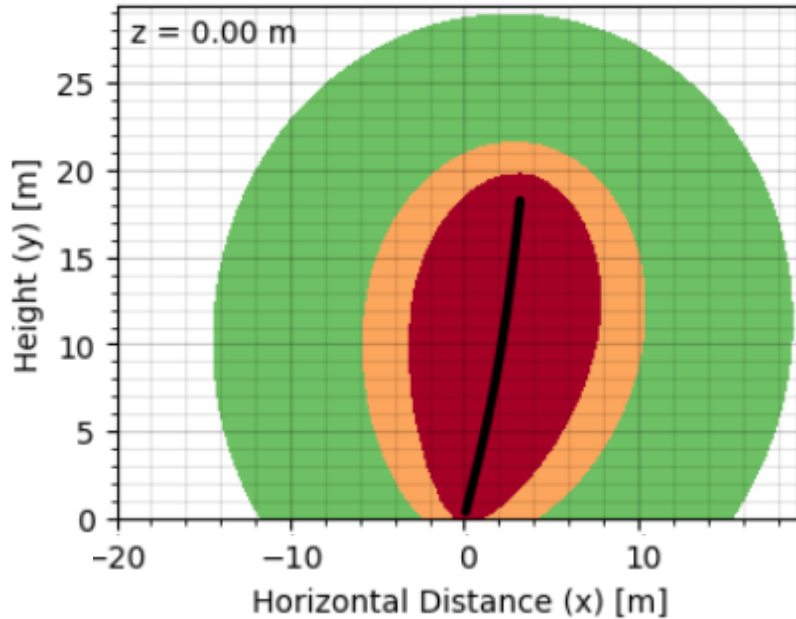


Hole in pipe pit - Radiation

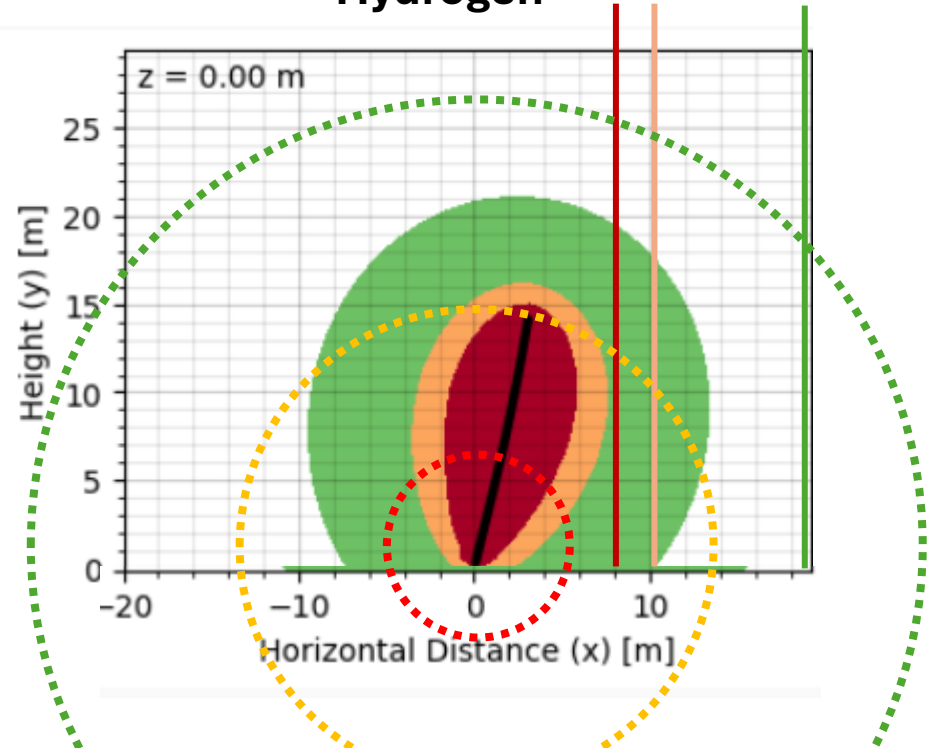


-  No effect (5 kPa)
-  Injury (16.5 kPa)
-  Fatality (100 kPa)

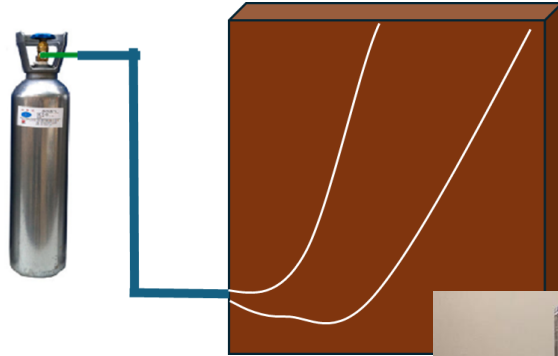
Natural gas (Methane)



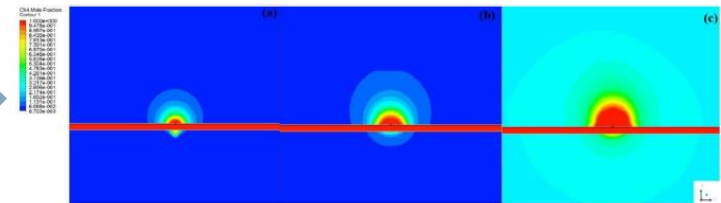
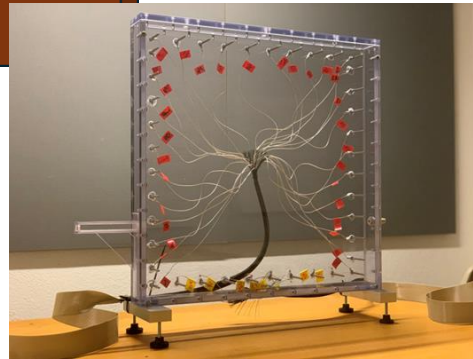
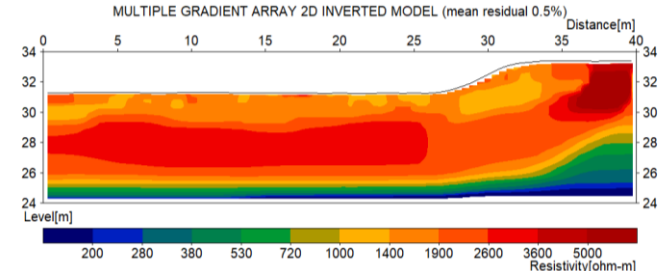
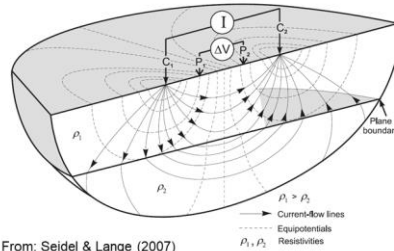
Hydrogen



Underground release



Measurement principle



Summary

- **Scenario selection** is very important for safety distance, but difficult to scientifically motivate → Authorities & Standardization (ISO, CEN etc)

- **Consequence models** are also important!
 - Modeling of **heat radiation** from hydrogen jet flames is performed using an extensive database. Refinement for large flames, and validation, is needed.
 - Model for **boyancy** of combustion products developed
 - Experiments for **overpressure from delayed ignition** is planned for this fall (or spring 2026)
 - Experiments and modeling of **underground release** are ongoing

