Canadian Hydrogen Convention

POSTER SESSION INFORMATION

WHY PRESENT A POSTER?

Participating in the Poster Session at the Canadian Hydrogen Convention Technical Conference is a great way to showcase your research, product, or service to high-level conference and exhibition delegates. In addition, your poster will be on display on both days of the conference and exhibition.

STEP 1: CONFIRM PARTICIPATION

Confirm your participation to the Poster Session by email to Dusan Krnjaja dusankrnjaja@dmgevents.com by **February 29, 2024.**

STEP 2: REGISTER

All Poster Session presenters will need to register for the technical conference and pay the poster fee online by **Friday, March 15, 2024.**

The fee for Poster Session participation for post secondary representatives is **$495.00 CAD** - discount code **TECHPOSSTU**. For company representatives the fee is **$795.00** CAD - discount code **TECHPOS795** to be used

Poster fee includes a two-day discounted technical conference pass. The poster fee also covers the printing cost and assembly of the poster before and onsite at the event. ***PLEASE NOTE: ALL PARTICIPANTS WILL NEED TO PAY THE FEE BEFORE THE POSTER WILL BE PRINTED.***

Registration steps below:

- To register please go to https://www.hydrogenexpo.com/register/
- Select Technical Courses then add the appropriate discount code and click apply.
- Pay by credit card (Visa or Mastercard)
- Once the payment has gone through you will receive a confirmation email for your registration

STEP 3: CREATE POSTER

OFFICIAL POSTER SIZE: **760mm (W) x 1220mm (H)**

The poster **MUST** include the following information at the **TOP** of the document:

- Poster Title
- Author(s) of Poster
- Name of Company
- Contact Information
- Assigned CHC number

TIPS AND RECOMMENDATIONS FOR POSTER DESIGN

- Poster must be in **color**, using the **font "Helvetica"**, please ensure the font is large enough to read from several feet away.
- Include more diagrams instead of text, this will allow for more opportunity to engage with exhibition visitors and conference delegates. It's best to keep it informative and visually interesting.
- The poster can be designed by your marketing department if you have one or can be designed by yourself.
- The poster will be printed on foam board to ensure that all the posters are visually consistent.

STEP 4: SUBMIT POSTER FILE

DEADLINE TO SUBMIT POSTER FILE: **FRIDAY, MARCH 22, 2024**

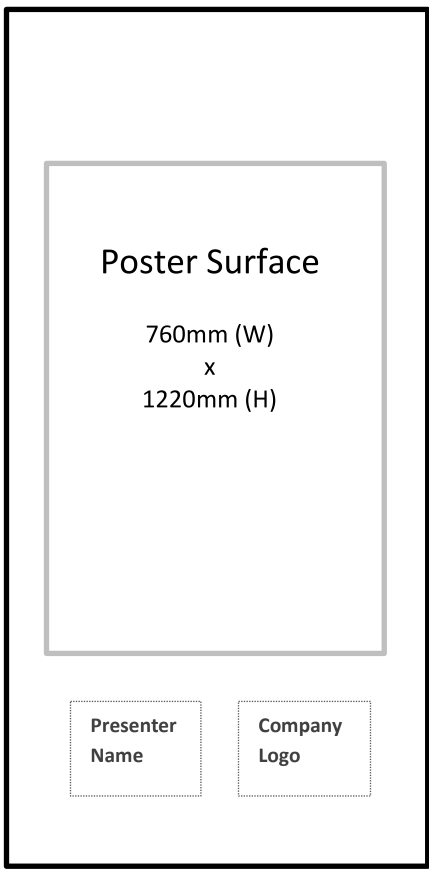
- The file must be converted to a **Print Ready PDF Format**
- If the PDF file is 10 MB or smaller – you can email it directly to Dusan Krnjaja **dusankrnjaja@dmgevents.com**
- If the file is too big to send via email, please let us know and we will provide a link for you to use to transfer the file.

STEP 5: ONSITE AT THE EVENT

The posters will be displayed in the designated Poster Session area on the exhibition show floor on all three days of the show and conference from April 23-24, 2024.

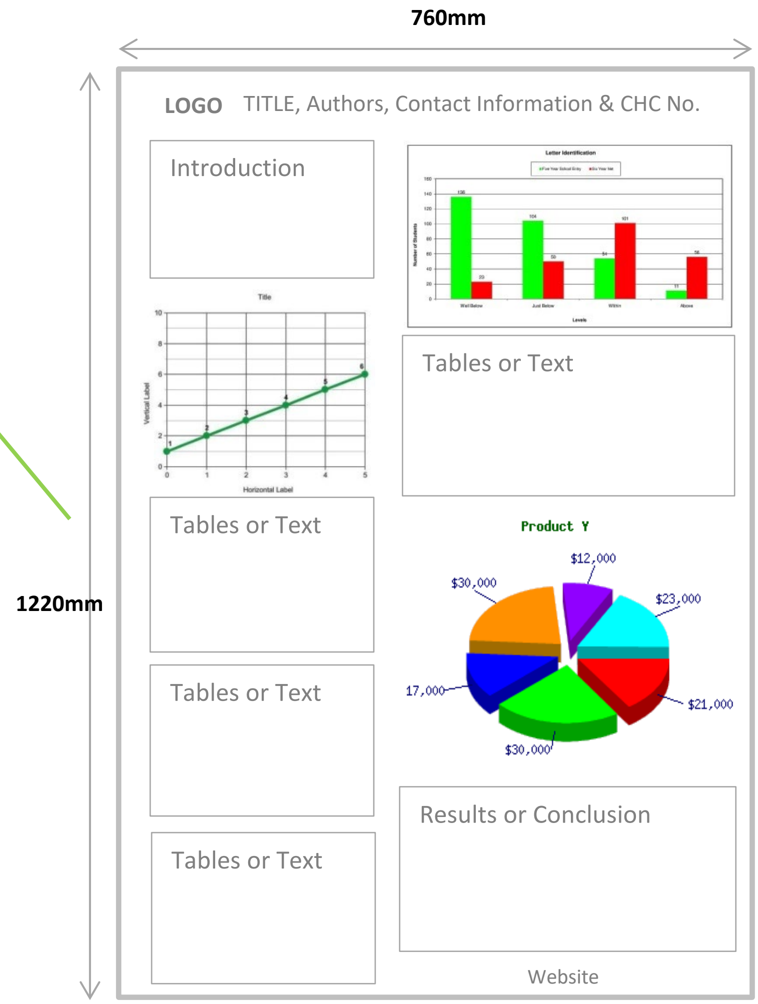
- Posters will be printed and assembled before you arrive.
- Posters will be organized and grouped together on the exhibition floor in a designated area.
- You are not required to be beside your poster the entire two days, but we do recommend you be near your poster during the conference lunch and networking breaks. Exact times will be provided closer to the conference.
- Ensure you bring plenty of business cards to distribute to conference delegates and exhibition visitors.

POSTER SESSION VISUAL AID



POSTER GUIDELINES (PRESENTER WILL DESIGN)

- Printed poster size is **760mm x 1220 mm**
- Font **MUST** be Helvetica
- Poster **MUST** include the following information:
  - **Full Poster Title**
  - **Author(s) of Poster** (Name, job title and company)
  - **Name or Logo of Company**
  - **Contact Information** (Email, telephone number and website address)
  - **Submission ID Number** (Number will be assigned to presenter)

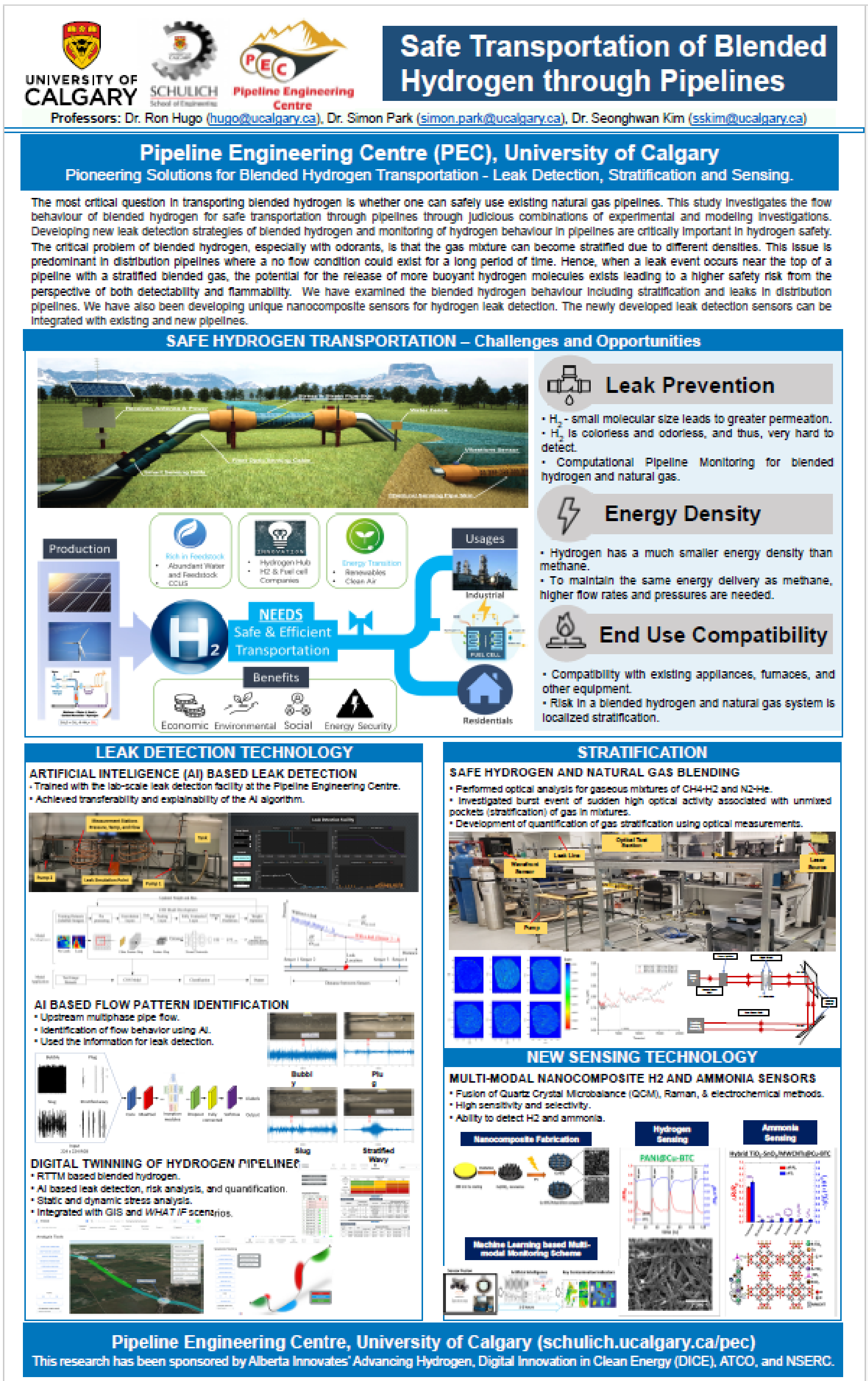


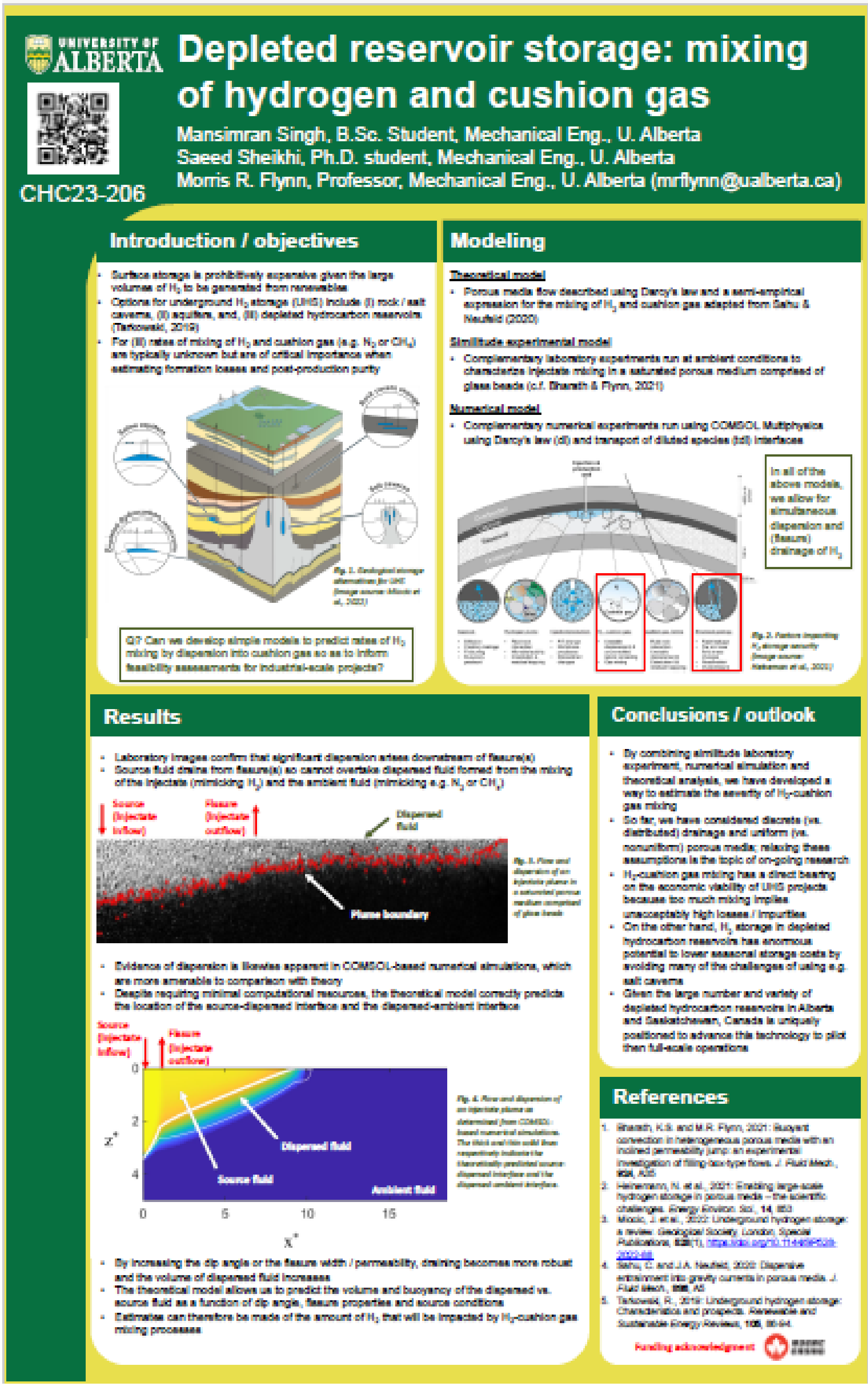
POSTER SESSION VISUAL AID

A visual representation of the Poster Session layout on the exhibition floor from previous Canadian Hydrogen Conventions.

Canadian Hydrogen Convention

EXAMPLES OF A SUCCESSFUL PAST POSTERS





UNIVERSITY OF ALBERTA
Depleted reservoir storage: mixing of hydrogen and cushion gas
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CHC23-206
Introduction / objectives
Surface storage is prohibitively expensive given the large volumes of H2 to be generated from renewables
Options for underground H2 storage (UHS) include (i) rock / salt caverns, (ii) aquifers, and, (iii) depleted hydrocarbon reservoirs (Tarkowski, 2019)
For (iii) rates of mixing of H2 and cushion gas (e.g. N2 or CH4) are typically unknown but are of critical importance when estimating formation losses and post-production purity
Fig. 1. Geological storage alternatives for UHS (Image source: Miocic et al., 2022)
Q? Can we develop simple models to predict rates of H2 mixing by dispersion into cushion gas so as to inform feasibility assessments for industrial-scale projects?
Modeling
Theoretical model
Porous media flow described using Darcy's law and a semi-empirical expression for the mixing of H2 and cushion gas adapted from Sahu & Neufeld (2020)
Similitude experimental model
Complementary laboratory experiments run at ambient conditions to characterize injectate mixing in a saturated porous medium comprised of glass beads (c.f. Bharath & Flynn, 2021)
Numerical model
Complementary numerical experiments run using COMSOL Multiphysics using Darcy's law (dl) and transport of diluted species (tds) interfaces
In all of the above models, we allow for simultaneous dispersion and (fissure) drainage of H2
Fig. 2. Factors impacting H2 storage security (Image source: Heinemann et al., 2021)
Results
Laboratory images confirm that significant dispersion arises downstream of fissure(s)
Source fluid drains from fissure(s) so cannot overtake dispersed fluid formed from the mixing of the injectate (mimicking H2) and the ambient fluid (mimicking e.g. N2 or CH4)
Source (injectate inflow)
Fissure (injectate outflow)
Dispersed fluid
Plume boundary
Fig. 3. Flow and dispersion of an injectate plume in a saturated porous medium comprised of glass beads
Evidence of dispersion is likewise apparent in COMSOL-based numerical simulations, which are more amenable to comparison with theory
Despite requiring minimal computational resources, the theoretical model correctly predicts the location of the source-dispersed interface and the dispersed-ambient interface
Source (injectate inflow)
Fissure (injectate outflow)
Dispersed fluid
Source fluid
Ambient fluid
z*
x*
0
2
4
0
5
10
15
Fig. 4. Flow and dispersion of an injectate plume as determined from COMSOL-based numerical simulations. The thick and thin solid lines respectively indicate the theoretically predicted source-dispersed interface and the dispersed-ambient interface.
By increasing the dip angle or the fissure width / permeability, draining becomes more robust and the volume of dispersed fluid increases
The theoretical model allows us to predict the volume and buoyancy of the dispersed vs. source fluid as a function of dip angle, fissure properties and source conditions
Estimates can therefore be made of the amount of H2 that will be impacted by H2-cushion gas mixing processes
Conclusions / outlook
By combining similitude laboratory experiment, numerical simulation and theoretical analysis, we have developed a way to estimate the severity of H2-cushion gas mixing
So far, we have considered discrete (vs. distributed) drainage and uniform (vs. nonuniform) porous media; relaxing these assumptions is the topic of on-going research
H2-cushion gas mixing has a direct bearing on the economic viability of UHS projects because too much mixing implies unacceptably high losses / impurities
On the other hand, H2 storage in depleted hydrocarbon reservoirs has enormous potential to lower seasonal storage costs by avoiding many of the challenges of using e.g. salt caverns
Given the large number and variety of depleted hydrocarbon reservoirs in Alberta and Saskatchewan, Canada is uniquely positioned to advance this technology to pilot then full-scale operations
References
1. Bharath, K.S. and M.R. Flynn, 2021: Buoyant convection in heterogeneous porous media with an inclined permeability jump: an experimental investigation of filling-box-type flows. J. Fluid Mech.
2. Heinemann, N. et al., 2021: Enabling large-scale hydrogen storage in porous media – the scientific challenges. Energy Environ. Sci., 14
3. Miocic, J. et al., 2022: Underground hydrogen storage: a review. Geological Society, London, Special Publications
4. Sahu, C. and J.A. Neufeld, 2020: Dispersive entrainment into gravity currents in porous media. J. Fluid Mech.
5. Tarkowski, R., 2019: Underground hydrogen storage: Characteristics and prospects. Renewable and Sustainable Energy Reviews, 105, 86-94.
Funding acknowledgment