



Hydrogen Experimental Facilities at Whiteshell Labs

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R&D Program on Hydrogen Behavior at AECL

- **AECL has a comprehensive R&D program to acquire understanding of key phenomena and to develop tools for accident analysis since early 1970s. Areas of research include:**
 - **Hydrogen Distribution**
 - **Hydrogen Combustion**
 - **Hydrogen Mitigation**
 - **Containment Response**



Goals of R&D Programs

- **Acquire fundamental understanding of key combustion phenomena relevant to postulated CANDU reactor accident scenarios**
- **Develop computer models for predicting gas distribution and combustion pressure**



Experimental Programs at AECL

- **Recent research programs include:**
 - **Gas distribution under accident conditions**
 - **Mechanisms and dynamics of standing flames**
 - **Mechanisms and dynamics of vented combustion**
 - **Flame acceleration and transition to detonation**
 - **Dynamics of flame jet ignition**



Research Facilities for Hydrogen at WL

- **Large Scale Vented Combustion Test Facility**
- **Containment Test Facility**
- **Diffusion Flame Facility**



Large Scale Vented Combustion Test Facility (LSVCTF)



The Large-Scale Vented Combustion Test Facility (LSVCTF) is a 10-m long, 4-m wide, 3-m high rectangular enclosure with an internal volume of 120 m³. The test chamber, including the end walls, is electrically trace-heated and heavily insulated to maintain temperatures in excess of 100°C for extended periods of time. The combustion chamber can be subdivided into 2 or 3 compartments. Variable sizes of vent openings are available between compartments and to the outside.



Large Scale Vented Combustion Test Facility





Containment Test Facility (CTF)



The Containment Test Facility (CTF) consists of a 6-m³ sphere and a 10-m³ cylinder, both rated for pressures up to 10 MPa and trace-heated for operation at temperatures up to 150°C. The large vessels may be inter-connected by 30 cm and 50 cm diameter ducts. The CTF is designed to investigate the fundamentals of combustion phenomena. These include flammability limits, ignition, turbulent combustion, flame acceleration, detonation, detonation transition.



Containment Test Facility



A 28cm-diameter and 9m-long combustion pipe with a design pressure of 10MPa. Obstacles can be mounted inside this pipe to induce flame acceleration. This apparatus has been used to determine the run-up distances for supersonic flames and DDT.



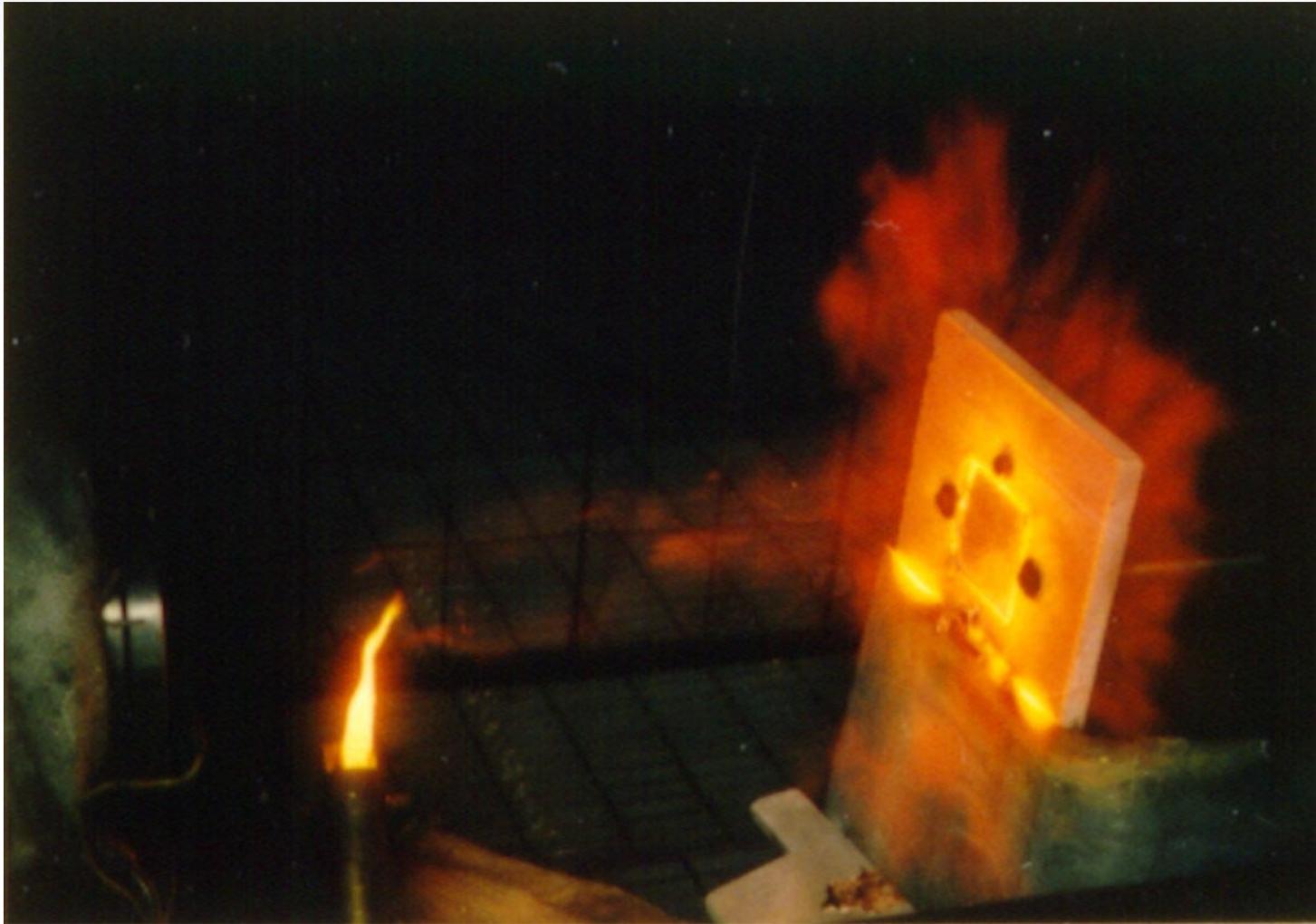
Diffusion Flame Facility (DFF)



The Diffusion Flame Facility (DFF) consists of a burner with associated gas supply lines and instrumentation housed within a modified grain silo (5 m diameter and 8 m height), which is insulated to retain heat for experiments that involve an air / steam environment. Tests with H_2 / steam jet flames (up to 15 cm in diameter) in air / steam atmosphere (up to 30% steam by volume) can be performed in this facility.



Hydrogen Diffusion Flame





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