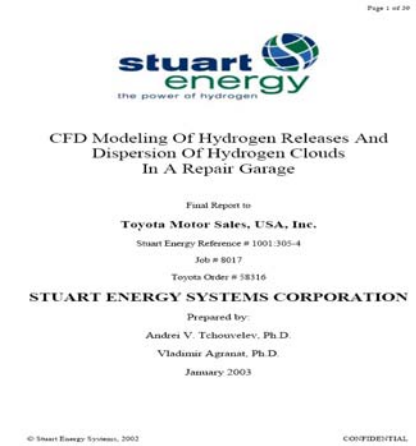
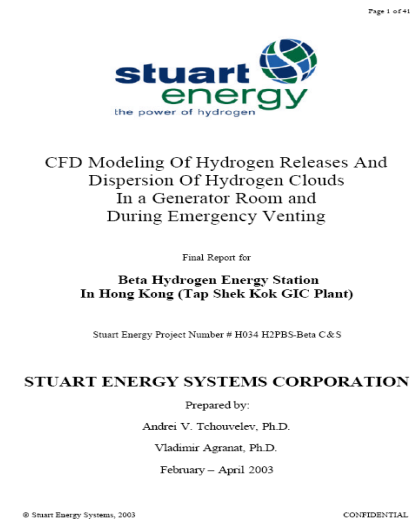
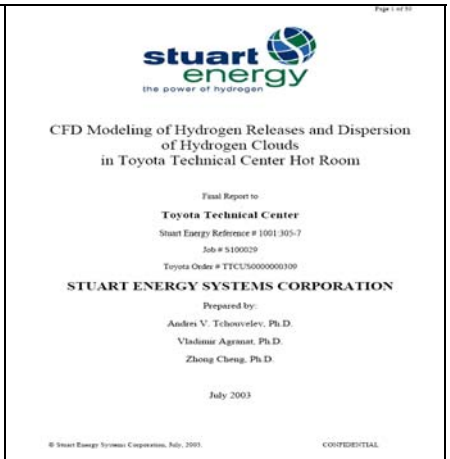
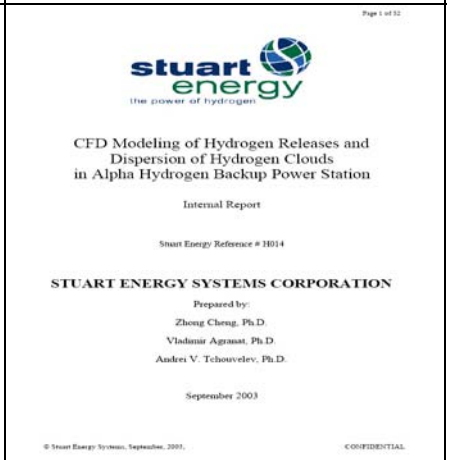
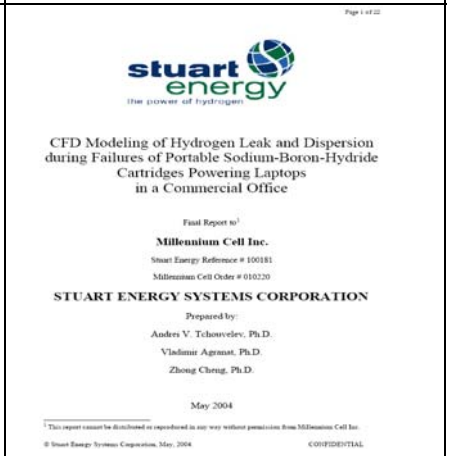
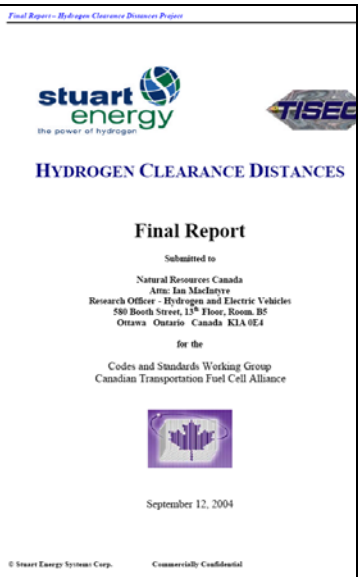
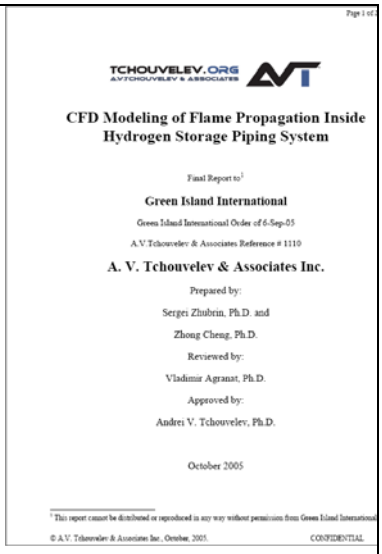
Previous Relevant Experience

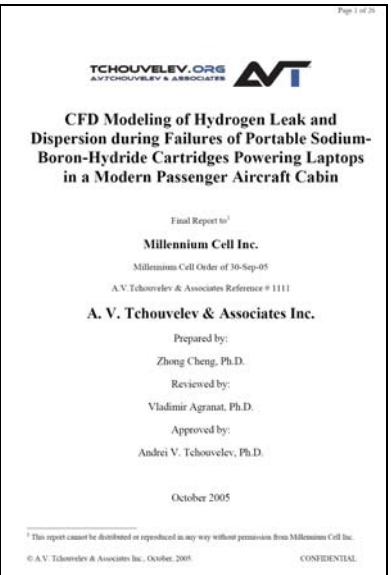
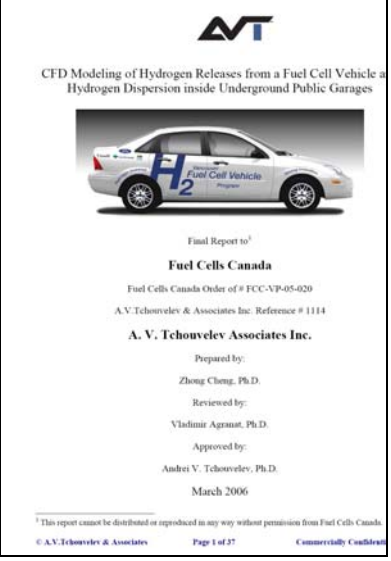
The AVT team has led and successfully completed on time and on budget 14 (fourteen) CFD and risk assessment projects within 2002 – 2008 as summarized below:

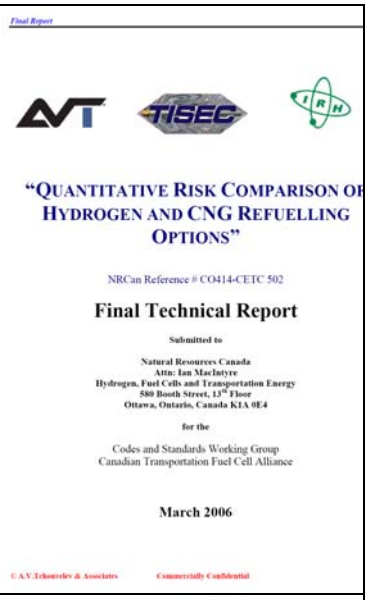
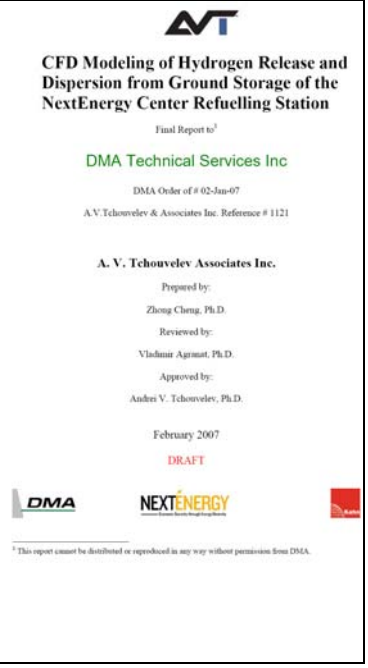
Project Name / Customer / Project Dates	Main Project Objectives	Reference
CFD Modeling Of Hydrogen Releases And Dispersion Of Hydrogen Clouds In A Repair Garage Toyota Motor Sales, USA October 2002 – January 2003	To model transient 3-D dispersion patterns of hydrogen emissions inside a repair garage under conditions specified by the customer. To assess the effectiveness of specified ventilation system designs. To educate local regulatory authorities in regards to hydrogen releases and to facilitate obtaining necessary approvals.	
CFD Modeling Of Hydrogen Releases And Dispersion Of Hydrogen Clouds In a Generator Room and During Emergency Venting Stuart Energy / CKI, Hong Kong February – April 2003	To model transient 3-D dispersion patterns of hydrogen emissions inside a generator room and during emergency venting under conditions specified by design requirements. To assess the effectiveness of selected ventilation design in the generator room. To assess the effectiveness of selected hydrogen venting options outdoors. To educate local regulatory authorities in Hong Kong in regards to hydrogen releases and to facilitate obtaining necessary approvals.	

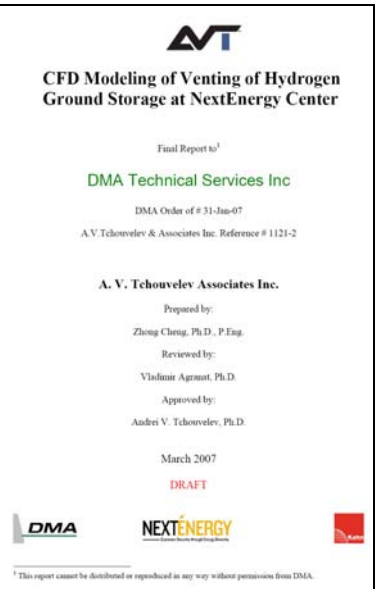
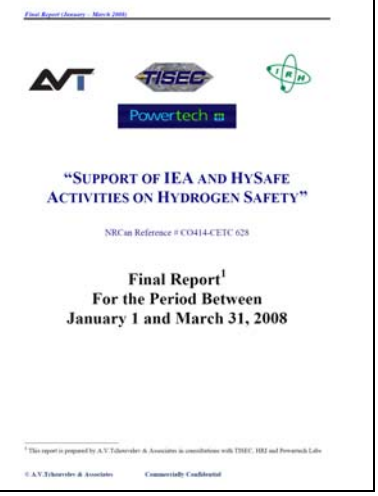
CFD Modeling of Hydrogen Releases and Dispersion of Hydrogen Clouds in Toyota Technical Center Hot Room Toyota Technical Centre, USA May – July 2003	To model steady-state and transient 3-D dispersion patterns of hydrogen emissions inside a Toyota Technical Center (TTC) Hot Room under conditions specified by the customer. To recommend appropriate locations for hydrogen sensors inside the Hot Room, based on the above modeling results and specified conditions by the customer.	
CFD Modeling of Hydrogen Releases and Dispersion of Hydrogen Clouds in Alpha Hydrogen Backup Power Station Stuart Energy internal study July – September 2003	To model transient 3-D dispersion patterns of hydrogen emissions inside a generator room under selected failure conditions. To assess the effectiveness of selected hydrogen sensor locations and ventilation design in the generator room. To facilitate obtaining necessary approvals for Alpha H2BPS. facility.	
CFD Modeling of Hydrogen Leak and Dispersion during Failures of Portable Sodium-Boron-Hydride Cartridges Powering Laptops in a Commercial Office Millennium Cell, USA May 2004	To model steady-state 3-D dispersion patterns of hydrogen emissions during potential failure scenarios of portable sodium-boron-hydride cartridges powering laptops in a commercial office under conditions specified by the customer. To facilitate obtaining necessary approvals from authorities having jurisdiction.	

Hydrogen Clearance Distances Natural Resources Canada / Canadian Transportation Fuel Cell Alliance October 2003 – September 2004	To develop sound scientific and engineering specifications that can be used to specify quantitative values for: - Clearance distances for hydrogen storage, production and handling components in hydrogen energy systems; - Hazardous zone classifications; - Declassifying hazardous zones with ventilation. To provide clear guidelines for the use of these new specifications in commercial applications. To use the project data to develop scientifically based guidelines for the Canadian Hydrogen Installation Code and the Canadian Electrical Code.	
CFD Validation, Calibration and Enhancement Project Natural Resources Canada / Canadian Transportation Fuel Cell Alliance June 2004 (started under Stuart Energy) – May 2005 (renewed in April 2005 under A.V.Tchouvelev & Associates after Stuart's acquisition by Hydrogenics)	To improve understanding of hydrogen gas properties and its dispersion during various type of intended and unintended releases in enclosed, semi-enclosed and unenclosed environments. To assist an on-going codes and standards development work for hydrogen systems including establishment of ventilation requirements, clearance distances and hazardous locations. To improve consequence analysis of potential failure scenarios of hydrogen containing equipment for a quantitative risk assessment.	

CFD Modeling Of Flame Propagation Inside Hydrogen Storage Piping System Green Island International, Hong Kong September – October 2005	To model transient hydrogen and oxygen stoicheometric mixture flame propagation inside hydrogen storage piping to simulate worst case oxygen ingress into the storage system with consecutive mixture ignition. To prove simultaneous explosions of storage vessels is not feasible. To support Quantitative Risk Assessment findings. To facilitate obtaining necessary approvals.	 TCHOUVELEV.ORG A.V.TCHOUVELEV & ASSOCIATES **CFD Modeling of Flame Propagation Inside Hydrogen Storage Piping System** Final Report to[1] **Green Island International** Green Island International Order of 6-Sep-05 A.V.Tchouvelev & Associates Reference # 1110 **A. V. Tchouvelev & Associates Inc.** Prepared by: Sergei Zhubrin, Ph.D. and Zhong Cheng, Ph.D. Reviewed by: Vladimir Agranat, Ph.D. Approved by: Andrei V. Tchouvelev, Ph.D. October 2005 [1] This report cannot be distributed or reproduced in any way without permission from Green Island International © A.V. Tchouvelev & Associates Inc., October, 2005. CONFIDENTIAL

CFD Modeling of Hydrogen Leak and Dispersion during Failures of Portable Sodium-Boron-Hydride Cartridges Powering Laptops in a Modern Passenger Aircraft Cabin Millennium Cell, USA October 2005	To model steady-state 3-D dispersion patterns of hydrogen emissions during potential failure scenarios of portable sodium-boron-hydride cartridges powering laptops in a modern passenger aircraft cabin under conditions specified by the customer. To facilitate obtaining necessary approvals from authorities having jurisdiction.	 TCHOUVELEV.ORG A.V.TCHOUVELEV & ASSOCIATES CFD Modeling of Hydrogen Leak and Dispersion during Failures of Portable Sodium-Boron-Hydride Cartridges Powering Laptops in a Modern Passenger Aircraft Cabin Final Report to Millennium Cell Inc. Millennium Cell Order of 30-Sep-05 A.V.Tchouvelev & Associates Reference # 1111 A. V. Tchouvelev & Associates Inc. Prepared by: Zhong Cheng, Ph.D. Reviewed by: Vladimir Agranat, Ph.D. Approved by: Andrei V. Tchouvelev, Ph.D. October 2005 This report cannot be distributed or reproduced in any way without permission from Millennium Cell Inc. © A.V. Tchouvelev & Associates Inc., October, 2005 CONFIDENTIAL
CFD Modeling Of Hydrogen Releases From a Fuel Cell Vehicle And Hydrogen Dispersion Inside Underground Public Garages Fuel Cells Canada January – March 2006	To model transient 3-D release and dispersion patterns of hydrogen emissions from a tailpipe of a fuel cell vehicle inside underground public garages under conditions specified by the customer. To assess the effectiveness of existing ventilation system designs. To educate local regulatory authorities in regards to hydrogen releases and to facilitate obtaining necessary approvals.	 CFD Modeling of Hydrogen Releases from a Fuel Cell Vehicle a Hydrogen Dispersion inside Underground Public Garages Final Report to Fuel Cells Canada Fuel Cells Canada Order of # FCC-VP-05-020 A.V.Tchouvelev & Associates Inc. Reference # 1114 A. V. Tchouvelev Associates Inc. Prepared by: Zhong Cheng, Ph.D. Reviewed by: Vladimir Agranat, Ph.D. Approved by: Andrei V. Tchouvelev, Ph.D. March 2006 This report cannot be distributed or reproduced in any way without permission from Fuel Cells Canada. © A.V.Tchouvelev & Associates Page 1 of 37 Commercially Confidential

Quantitative Risk Comparison of Hydrogen and CNG Refuelling Options Natural Resources Canada / Canadian Transportation Fuel Cell Alliance April 2005 – March 2006	To quantitatively compare risk from stand-out features of hydrogen and CNG refuelling technologies using CFD modeling tools. To assist an on-going codes and standards development work for hydrogen systems. To improve approach and methodology of risk analysis of hydrogen systems.	
CFD Modeling of Hydrogen Release and Dispersion from Ground Storage of the NextEnergy Center Refuelling Station DMA Technical Services / NextEnergy December 2006 – February 2007	To model transient 3-D dispersion patterns of the hydrogen emissions during release of hydrogen from the ground storage inside NextEnergy Refueling Station located close to a building within a State University. To perform numerical simulations of thermal effects from potential immediate ignition of the hydrogen jet. To demonstrate the potential outcomes of a catastrophic loss of containment at the ground storage piping manifold in order to develop risk mitigation engineering solutions.	

CFD Modeling of Venting of Hydrogen Ground Storage at NextEnergy Center DMA Technical Services / NextEnergy January – March 2007	To model transient 3-D dispersion patterns of the hydrogen emissions, represented by a flammable (4 to 75% vol.) H_2 cloud during release of hydrogen from the vent stack in the event of venting of the ground storage at the NextEnergy Center located close to a building within a State University. To perform numerical simulations of thermal effects from potential immediate ignition of the hydrogen jet. To demonstrate the potential outcome of the ground storage venting.	 CFD Modeling of Venting of Hydrogen Ground Storage at NextEnergy Center Final Report to[1] DMA Technical Services Inc DMA Order of # 31-Jan-07 A.V.Tchouvelev & Associates Inc. Reference # 1121-2 A. V. Tchouvelev Associates Inc. Prepared by: Zhong Cheng, Ph.D., P.Eng. Reviewed by: Vladimir Agranat, Ph.D. Approved by: Andrei V. Tchouvelev, Ph.D. March 2007 DRAFT DMA NEXTENERGY [1] This report cannot be distributed or reproduced in any way without permission from DMA.
IEA HIA Task 19 Hydrogen Safety and EU Network of Excellence HySafe CTFCA / Natural Resources Canada July 2006 – March 2008	To provide leadership in IEA HIA Task 19 Subtask A Risk Management as well as participate in other subtasks and manage Canadian contribution. To participate in selected work packages on risk management and CFD modeling of HySafe.	 Powertech "SUPPORT OF IEA AND HYSAFE ACTIVITIES ON HYDROGEN SAFETY" NRCan Reference # CO414-CETC 628 Final Report[1] For the Period Between January 1 and March 31, 2008 © A.V.Tchouvelev & Associates Commercially Confidential

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