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PNNL-31066

Hydrogen Safety Outreach to Expedite H2 Fueling and Energy Project Deployment and Promote Public acceptance for Zero Emission Vehicles and Reliable Distributed Power Generation

CRADA 396

March 2021

Nick F. Barilo

U.S. DEPARTMENT OF ENERGY

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

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Pacific Northwest National Laboratory
Richland, Washington 99354

Cooperative Research and Development Agreement (CRADA) Final Report

Report Date: March 10, 2021

In accordance with Requirements set forth in the terms of the CRADA, this document is the CRADA Final Report, including a list of Subject Inventions, to be provided to PNNL Information Release who will forward to the DOE Office of Scientific and Technical Information as part of the commitment to the public to demonstrate results of federally funded research.

Parties to the Agreement:

PNNL/Battelle Memorial Institute
Connecticut Center for Advanced Technology, Inc (CCAT)

CRADA number: H2@ SCALE Program No. 396

CRADA Title: Hydrogen Safety Outreach to Expedite H2 Fueling and Energy Project Deployment and Promote Public acceptance for Zero Emission Vehicles and Reliable Distributed Power Generation

Responsible Technical Contact at DOE Lab:

Mr. Nick Barilo
Senior Systems Engineer
Pacific Northwest National Laboratory
902 Battelle Blvd
Richland, WA 99354
Tel: (509) 371-7894
nick.barilo@pnnl.gov

Name and Email Address of POC at Company:

Mr. Joel M. Rinebold
Director of Energy Initiatives
Connecticut Center for Advanced Technologies
Tel: (860) 282-4205
jrinebold@ccat.us

DOE Program Office: Hydrogen and Fuel Cell Technologies Office

Joint Work Statement Funding Table showing DOE funding commitment:

Funding	Project Year 1	Project Year 2	Project Year 3	Project Year 4	Project Year 5	Totals
Government	$ 53,800	$ 77,000				$ 130,800
DOE	$ 53,800	$ 77,000				$ 130,800
Other						
Total Govt.	$ 53,800	$ 77,000				$ 130,800
Participant	$ 14,500					$ 14,500
In-Kind						
Funds-In	$ 14,500					$ 14,500
FAC						
Total Participant	$ 14,500					$ 14,500
Total CRADA Value	$ 68,300	$ 77,000				$ 145,300

Executive Summary of CRADA Work:

The PNNL Hydrogen Safety Panel (HSP) is an essential resource to address the concerns about hydrogen as a safe and sustainable energy carrier, using over 400 years of cumulative hydrogen safety experience, including committee members from National Fire Protection Association, Society of Automotive Engineers, American Society of Mechanical Engineers, and the International Standards Organization.

A key objective of the PNNL HSP is to integrate safety planning into funded hydrogen projects to ensure that all projects address related safety practices. This objective is crucial when siting, designing, and building hydrogen facilities and light duty hydrogen refueling stations.

This CRADA utilized PNNL as a resource to assist stakeholders on the safe implementation of hydrogen fuel cell technologies. This activity explored and helped develop relationships through outreach activities, training sessions, meetings, and workshops in the Northeast U.S. to achieve the following objectives:

- Raise awareness of the PNNL HSP among state/local officials and project developers;
- Establish working relationships with key state and local organizations to enable seamless incident response and development of safety lessons learned;
- Identify types of projects that would benefit from PNNL involvement; and
- Develop market strategies for additional safety reviews.

The activities conducted under this CRADA contribute to widening the availability and communication of safety related information which are crucial to ensuring the safe operation of future hydrogen and fuel cell technology systems. The entire hydrogen community can benefit from these activities that share hydrogen safety related knowledge openly and broadly.

Summary of Research Results:
Demonstrated safety in the production, distribution, dispensing, and use of hydrogen builds public acceptance that is critical to the successful implementation of a hydrogen refueling infrastructure and the widespread use of fuel cell technologies in transportation. Commercial hydrogen fuel technologies are starting to be deployed, which amplifies the need for attention to be paid to such new technologies because of public unfamiliarity. Loss of public confidence at an early stage of development could significantly delay or even preclude further progress in development and deployment of hydrogen and fuel cell technologies as zero-emission solutions.

To provide much needed open and broad hydrogen safety communication and training, the CRADA focused on using outreach and stakeholder engagement activities to raise awareness and discuss opportunities for collaboration with the HSP. To that end, CCAT and PNNL conducted hydrogen safety stakeholder sessions (outreach, training, workshops, and meetings) for building and code officials, project developers, energy policy makers and other interested stakeholders. The activities took place in Massachusetts, Connecticut, New York, New Jersey, Maryland, and Delaware between September 2018 and June 2019.

The outreach events provided a background on the current activities and progress of hydrogen and fuel cell technologies, the necessary safety considerations and beneficial resources. The sessions were configured to utilize the presentation and learning segment to foster stakeholder discussions and explore opportunities to utilize the HSP to support demonstration and early commercialization projects. The attendees included representatives from industry, code officials, public officials, associations, and other interested stakeholders based on the preliminary list of locations for potential outreach.

It is estimated that more than 300 persons attended the stakeholder outreach meetings at the following locations:

- New Haven Fire Training Academy in New Haven, CT
- New England Association of Fire Marshals, Westerly, RI
- New Jersey Fuel Cell Coalition training session and stakeholder meeting at Rutgers University in New Brunswick, NJ.
- New England Building Officials Education Association, University of Massachusetts at Amherst, MA.
- New York Battery & Energy Storage Technology Consortium, Albany, NY
- New York Department of Environmental Conservation (DEC), Albany, NY
- Massachusetts State Fire Board, Stow, MA
- Industry and stakeholder meeting, Cambridge, MA.
- College, NJ
- Baltimore, MD
- University of Delaware, Newark, DE

As a part of the CRADA activities, CCAT contributed to the following effort:

- Successfully secured continuing education credits from the State of Connecticut Office of Education & Data Management (OEDM) for code officials that participated in the four training sessions
- Obtained confirmation from the State of Massachusetts Office of Public Safety and Inspections (OPS&I) that the materials presented at the training session in Westerly, RI and Amherst MA would also be acceptable for continuing education units (CEUs);

- Publicized the hydrogen safety sessions to potential attendees, including but not limited to email campaigns, website notices, press releases, flyers, and social media eight weeks prior to the sessions;
- Provided training surveys to gauge increased awareness of training materials;
- Tallied results of the surveys in Microsoft Excel format and provide to PNNL; and
- Assisted the HSP in the development and distribution of letters to key public officials in the states of Massachusetts, New Jersey, Rhode Island, New York, and Connecticut to highlight the services available through the HSP.

The stakeholder meetings were well received by the participants. While no specific projects were identified for HSP involvement, the sharing of safety knowledge and interaction with stakeholders was impactful on helping participants understand the benefit of fuel cell technologies and fundamental safety considerations for their deployment. This effort highlighted the leadership capabilities of the HSP as a significant safety resource for stakeholders. This type of interaction is ultimately beneficial for enabling greater public acceptance of this transformative technology.

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902 Battelle Boulevard
P.O. Box 999
Richland, WA 99354
1-888-375-PNNL (7665)

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