BOARD MEETING DATE: May 2, 2014 AGENDA NO. 4

PROPOSAL: Recognize Revenue, Execute Contracts and Purchase Equipment to Support Hydrogen Readiness in Early Market Communities

SYNOPSIS: In August 2013, under the AB 118 Program, the CEC issued a PON for projects to develop strategies for the deployment of alternative fuel infrastructure and encourage the adoption of alternative fuel vehicles. On March 12, 2014, the CEC issued a Revised Notice of Proposed Awards awarding $299,360 to the SCAQMD for a proposal to support hydrogen readiness in early market communities. This action is to recognize revenue in the amount of $299,360 from the CEC into the Hydrogen Fueling Station Special Revenue Fund (55) and to execute a contract in an amount not to exceed $299,360 with Bevilacqua-Knight, Inc. to conduct education and outreach activities to support hydrogen readiness in early market communities. This action also includes executing a contract to develop sampling and testing protocols for analyzing impurities in hydrogen automotive fuel per *SAE J2719* and for purchase of equipment for performing hydrogen fuel quality testing in an amount not to exceed $212,100 from the Clean Fuels Fund (31).

COMMITTEE: Technology, April 18, 2014; Recommended for Approval

RECOMMENDED ACTIONS:

1. Recognize upon receipt $299,360 from the CEC under the AB 118 Program into the Hydrogen Fueling Station Special Revenue Fund (55).
2. Authorize the Chairman to execute the following;
   a. A contract with Bevilacqua-Knight, Inc. (BKi) to support hydrogen readiness in early market communities in an amount not to exceed $299,360 from the Hydrogen Fueling Station Special Revenue Fund (55); and
   b. A contract with The Regents of the University of California to develop sampling and testing protocols for analyzing impurities in hydrogen automotive fuel per *SAE J2719* in amount not to exceed $120,000 from the Clean Fuels Fund (31).

3. Authorize the Procurement Manager to execute a purchase order with MKS Instruments for the purchase of a Fourier Transform Infrared Spectroscopy (FTIR) gas analyzer in an amount not to exceed $92,100 from the Clean Fuels Fund (31).

Barry R. Wallerstein, D.Env.
Executive Officer

MMM:LW

Background

The SCAQMD supports the development and deployment of alternative and renewable fuels for advanced transportation technologies including hydrogen fueling infrastructure. As stations are funded and built in multiples instead of one at a time, it is vital to address challenges in financing, planning and permitting stations and to build awareness about hydrogen and fuel cells in the early market communities. It is also necessary to ensure a reliable supply of hydrogen fuel, establish fueling stations, and be able to accurately measure the quantity and quality of the fuel in order to be able to sell the fuel on a commercial basis.

CEC PON-13-603

Through the AB 118 Alternative and Renewable Fuel and Vehicle Technology Program, the CEC provides funding to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. This grant program includes funding for the construction and commissioning of hydrogen stations. In August 2013, the CEC issued #PON-13-603 providing $2.1 million in grant funding to develop Alternative Fuel Readiness Plans that would provide strategies for the deployment of alternative fuel infrastructure and encourage the adoption of alternative fuel vehicles, including hydrogen fuel cell infrastructure and vehicles. One desired outcome of this funding opportunity was to establish workforce training programs, conduct public education and create and promote technology centers. The SCAQMD submitted a proposal in response to this PON to conduct education and outreach activities to support hydrogen readiness in early market communities, leveraging 25 years of experience in fuel cells and hydrogen and proposing to integrate activities with the California Fuel Cell Partnership (CaFCP) and California Hydrogen Business Council. On March 12, 2014, the CEC issued a Revised Notice of Proposed Awards, which included an award to the SCAQMD for this proposal.

Technical Analysis/FTIP Gas Analyzer

Proper codes and standards are essential for the commercial deployment of hydrogen and fuel cell technologies. The *SAE J2719* fuel quality standard has been adopted for hydrogen fuel quality; however, testing protocols, along with equipment that can measure hydrogen fuel quality at those levels, need to be assessed. The fuel quality

required by *SAE J2719* must be quantified at the vehicle-fueling station interface and a determination made as to how the presence of small amounts of contaminants may affect the performance and durability of proton exchange membrane (PEM) fuel cells. Current analyses of hydrogen fuel quality have to be enhanced or developed for approximately half of the fuel cell specifications.

Proposal

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This action is to recognize revenue from the CEC up to $299,360 into the Hydrogen Fueling Station Special Revenue Fund (55) to support hydrogen readiness in early market communities and to execute a contract with BKi, on behalf of the CaFCP (BKi manages the CaFCP), in an amount not to exceed $299,360 from the Hydrogen Fueling Station Special Revenue Fund (55) to conduct education and outreach activities to support hydrogen readiness in early market communities. Proposed activities would include the following:

- Provide hands-on training to active-duty fire fighters using a hydrogen vehicle prop commissioned by the internationally recognized HAMMER training facility.
- Provide local fire marshals and CalFire with education about NFPA 2, a fire code update and address any information gaps with local fire authorities.
- Develop station education materials for non-emergency response personnel and other decision-makers to dispel misinformation about safety.
- Perform marketing research and analysis with private fleet operators and individual drivers to understand their motivations for buying an alternative fuel vehicle, in general, and a fuel cell electric vehicle, in particular.
- Develop marketing and outreach materials and strategies to address target audiences and motivations.

Technical Analysis/FTIP Gas Analyzer

This action is also to execute a contract and purchase order from the Clean Fuels Fund (31), as follows: 1) a contract with The Regents of the University of California in the amount of $120,000 to conduct informed evaluation of current protocols and to propose enhanced protocols for analyzing impurities in hydrogen automotive fuel per *SAE J2719*; and 2) a purchase order with MKS Instruments in the amount of $92,100 for the purchase of an FTIR gas analyzer to perform hydrogen fuel quality testing.

The University of California at Irvine (UCI) has an Organized Research Unit called AirUCI (Atmospheric Integrated Research at the University of California at Irvine). AirUCI is a multidisciplinary environmental research group, representing partnerships between faculty at UCI campuses and international researchers, that is dedicated to understanding and solving critical issues relating to air pollution and other environmental issues. The AirUCI team, which includes Drs. Donald Blake, Sergey Nizkorodov and Hyun Ji (Julie) Lee, have expertise in chemical processes and

measurements that brings state-of-the-art techniques for measuring trace gases. Both Drs. Blake and Nizkorodov's research areas include development of new analytical methods and approaches to the evaluation of gases; Dr. Lee works under the guidance of Dr. Nizkorodov.

AirUCI will conduct an evaluation of current protocols and propose enhanced protocols as well as develop and implement method(s) to identity and quantify trace contaminants present in hydrogen fuel at hydrogen vehicle fueling stations located within the South Coast Air Basin. The short term goal is to detect contaminants at the concentrations specified in *SAE J2719* and in the *California Code of Regulations (CCR), Title 4, Division 9, Chapter 6, Article 8, Sections 4180-4181*. AirUCI will prepare a report on the feasibility of measuring trace contaminants as specified in these documents and make recommendations on the necessary instrumentation and measurement methodologies. They will also provide recommendations on additional trace contaminants that need determination and on instrument configurations and standard operation procedures (SOPs) to develop and establish a proper and comprehensive hydrogen quality assessment. The long term goal is to transfer all project results to the SCAQMD for establishing in-house expertise for analyzing hydrogen fuel purity on an on-going basis.

SCAQMD laboratory staff have investigated the applicability of various instruments and determined a purpose-designed FTIR gas analyzer for measuring certain contaminants within hydrogen fuel would be most cost-efficient. The equipment cost includes software, operational calibration recipes and training. A significant cost savings is realized by the purchase of this equipment. If this equipment were not acquired, separate analyses would have to be developed for sampling of acid halides (no known method for halogens such as chlorine or bromine), formaldehyde (HPLC analysis for formaldehyde at four hours per sample), and ammonia (impinger sampling and IC analysis for ammonia at four hours). Halogen gas sampling and analysis has yet to be scoped. This equipment will act as the cornerstone for analyzing hydrogen fuel purity.

Sole Source Justification

Section VIII.B.2 of the Procurement Policy and Procedures identifies four major provisions under which a sole source award may be justified. The request for sole source award with The Regents of the University of California/AirUCI is made under provision B.2.d (7): Research and development efforts with educational institutions and nonprofit organizations. AirUCI's team are experts in the sampling, testing and development of standard operating procedures for trace gas analyses. In addition, AirUCI has unique access to installed analytical instrumentations and equipment at UCI, thereby achieving significant cost savings to complete the project.

The request to purchase an FTIR gas analyzer on a sole source basis is made under provision VIII B.2.c(1): The unique experience and capabilities of the proposed contractor or contractor team; and under provision VIII B.2.c (2): The project involves the use of proprietary technology. The MKS Instruments FTIR system has been built with capabilities that no other unit currently on the market possesses. It has been designed and manufactured specifically for determining the properties of hydrogen fuel and is the only FTIR available that has the ability to recognize ammonia as a contaminant, a contaminant that could find its way into commercially produced hydrogen. The instruments cell length and proprietary software comes only from the identified vendor.

Benefits to SCAQMD

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The proposed contract is included in the *Technology Advancement Office 2014 Plan Update* under "Hydrogen and Fuel Cell Technologies and Infrastructure." The AQMP also relies on the expedited implementation of low-emission technologies and fuel cell vehicle related projects to help the SCAQMD to achieve its clean air goals. This work will assist in identifying the best, most cost-effective techniques to acquire all of the information necessary to ensure quality hydrogen fuel for the anticipated fuel cell vehicle rollout.

Technical Analysis/FTIR Gas Analyzer

The proposed contract and equipment purchase is included in the *Technology Advancement Office 2014 Plan Update* under "Hydrogen and Fuel Cell Technologies and Infrastructure." The current standards were intended to apply to limited-scale introduction of original equipment manufactured fuel cell vehicles (FCVs). This work will directly change these standards in concert with the progress of FCV technology and fuel quality testing. The effects of poor fuel quality on PEM fuel cell performance and durability will be minimized leading to the successful wide-scale deployment of FCVs. This project will provide an assessment of current SAE fuel quality standards testing protocols and the types of equipment that can be used to accurately measure hydrogen fuel quality, ultimately leading to the commercialization of hydrogen as an automotive fuel. By conducting multiple pilot analyses using sampling and analytical test methods developed and published by UCI (which are comparable to *ASTM International*), it can be determined if analytical enhancements and alternative analytical methodologies and/or instruments will be necessary.

Resource Impacts

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The CEC under the AB 118 Program has awarded the SCAQMD $299,360 to support hydrogen readiness in early market communities, and these funds will be recognized upon receipt into the Hydrogen Fueling Station Special Revenue Fund (55). The contract with BKi in the amount of $299,360 will be fully funded using these CEC pass-

through funds. The Hydrogen Fueling Station Special Revenue Fund was established to collect revenue from other government agencies to support projects increasing the utilization of clean fuels, including conducting education and outreach activities to support hydrogen readiness.

Technical Analysis/FTIR Gas Analyzer

The total cost for this project will not exceed $212,100 from the Clean Fuels Fund (31), comprising: 1) a contract with The Regents of the University of California, on behalf of AirUCI, in the amount of $120,000 to develop sampling and testing protocols for analyzing impurities in hydrogen automotive fuel per *SAE J2719;* and 2) a purchase order with MKS Instruments in the amount of $92,100 for the purchase of an FTIR gas analyzer to perform hydrogen fuel quality testing. Sufficient funds are available in the Clean Fuels Fund (31) for this proposed project. The Clean Fuels Program, under Health and Safety Code Sections 40448.5 and 40512 and Vehicle Code Section 9250.11, establishes mechanisms to collect revenues from mobile sources to support projects to increase the utilization of clean fuels, including the development of the necessary advanced enabling technologies. Funds collected from motor vehicles are restricted, by statute, to be used for projects and program activities related to mobile sources that support the objectives of the Clean Fuels Program.