Project Profile

Project Name:	PM 2.5 Emission Test and Factor Development
Project Number:	HS-2016-01
Proponent:	Canadian Energy Partnership for Environmental Innovation (CEPEI)
Funding Envelope:	Health and Safety
Timeframe:	August 20, 2015 to April 30, 2016

Project objectives

The objectives of the project are to:

- update PM2.5 emission factors and chemical speciation profiles that will be used for federal and provincial/territorial air quality permitting/licensing applicable to engines used in upstream/downstream oil and gas operations in Canada; and
- gain acceptance for using the new emission factors among industry, government, consultants and the community.

Project description

This project will generate new test data and update PM2.5 emission factors for natural gas-fired engines applicable to upstream and downstream oil and gas operations as well as customer emissions. The tests will be conducted using a proven dilution sampling method combined with ambient air sample collection and analysis methods to determine both the mass and chemical speciation of PM2.5 emissions. A modified version of U.S. EPA Conditional Test Method 039 (CTM 039) that has been recently applied to tests of several gas-fired sources will be used. The modified method combines key elements of the scientifically proven research dilution sampling method used in the U.S. program within the general framework and equipment of the published U.S. EPA method.

The chemical composition of the collected aerosols also will be determined (40+ elements by x-ray fluorescence; sulfate, nitrate, chloride and other ions by ion chromatography and organic and elemental carbon by thermal optical reflectance). These results will clarify the true contribution of sulfates. Chemically speciated PM2.5 profiles will be applicable to source apportionment and health risk analysis.

Tests will be conducted at two host sites: one will be a natural gas-fired combustion turbine employing lean premix low-NOX combustors; the other site will be a natural gas-fired lean burn reciprocating engine. Host sites will be representative of engine size and configurations of Canadian upstream and downstream oil and gas applications (such as compressor drives). They may also be representative of

power generation and cogeneration applications. The intent is to assure that the data can be extrapolated to the widest range of gas burning engines.

Project background

Atmospheric particles with aerodynamic diameter ≤2.5 microns (PM2.5) contribute to adverse human health, regional haze (visibility) and ecosystem effects. Most airborne PM2.5 derives from gaseous emissions that react slowly in the atmosphere to form fine particles ("secondary" PM2.5). The contribution of directly emitted ("primary") PM2.5 varies among different source types, but is relatively small for engines, boilers and other combustion equipment burning gaseous fuels. Nevertheless, PM2.5 emissions from natural gas-burning engines often receive exceptional scrutiny in populated urban areas.

Widely published PM2.5 emission factors are based on traditional emissions test methods for filterable and condensable PM2.5 using hot filter/cooled impinger techniques. Research shows these methods lack sufficient sensitivity to accurately and precisely measure the very low PM2.5 concentrations typical of gas-fired combustion sources. PM2.5 results from such methods may be biased high due to substances formed from gases in the samples after collection (often in the form of sulfates). Current PM2.5 emission factors for natural gas-fired engines therefore exaggerate estimated human health and environmental impacts and often unnecessarily aggravate concerns during plant siting and licensing. Dilution sampling methods offer greater sensitivity than PM2.5 test methods, leading to more accurate PM2.5 emission factors—based on tests conducted in the U.S. under a collaborative, multi-stakeholder government-industry research program.

Project approach

The project will be carried out using the following approach:

1) Kickoff;
2) Test Planning and Preparation;
3) Field Tests (mobilisation/demobilisation, sample collection, field QA oversight, sample analysis);
4) Test Report;
5) Emission Factor Update; and
6) Review Meeting.

Project deliverables

The deliverables from this project include the following:

1. A final report with comprehensive test results including the updated emission factors; and
2. Extension activities, such as presentations, to promote understanding and acceptance within the oil and gas sector.