ALBERTA INNOVATES

CLIMATE CHANGE INNOVATION AND TECHNOLOGY FRAMEWORK

Awardee Summary

CCITF PROGRAM	Clean Technology Development
PROJECT TITLE	Deployment of High Rate Methane Biofilters (HMBFs) with a multi-inlet air gas feed system to control methane emissions from oil well and battery sites
SECTOR	Methane Emissions Reduction
ORGANIZATION	University of Calgary, Department of Civil Engineering, Center for environmental Engineering and Education (CEERE)
PROJECT LEAD	Patrick Hettiaratchi
AI PROJECT ADVISOR	Paolo Bomben
GRANT AMOUNT	$373,000
START DATE	1/1/2019
END DATE	12/1/2021

PROJECT OBJECTIVE: Demonstrate the viability of using High Rate Methane Biofilters to control methane emissions associated with oil and gas industry operations.

PROJECT PROFILE: We have undertaken extensive research to develop methane-biofilters (MBF) as a viable technology to control point-source atmospheric emissions of methane (CH4), a key greenhouse gas. This technology involves operation of a granular media filter that supports the optimal growth of methanotrophs, aerobic bacteria capable of oxidizing CH4 without generating toxic by-products. Over the last two decades, we have conducted considerable research to understand the fundamental parameters that govern the behaviour of methanotrophs and successfully implemented passively-aerated MBFs at several locations in Alberta and British Columbia. These systems are easy to construct, but the CH4 oxidation potential is low because the MBF depth is limited by atmospheric oxygen (O2) diffusion. Since methanotrophs are aerobic organisms, it is necessary to deliver O2 to all parts of the MBF to achieve maximum performance. Our recent research has shown that by operating the MBFs in an actively aerated mode, we could achieve much higher CH4 oxidation efficiencies. In an actively-aerated MBF, or high-rate MBF (HMBF), a mixture of CH4 and air is fed into the filter using a novel gas feeding system. Since this enables the use of the entire HMBF to grow methanotrophs, HMBFs can treat high gas volumes, such as the ones encountered at oil facilities.

The goal of the current project is to develop and deploy HMBFs as a cost-effective technology to treat CH4-rich solution gas (or gas that cannot be recovered economically) associated with the upstream oil and gas sector.

The primary objectives are (1) to conduct experimental studies to identify the most suitable solution gas/air feeding system; (2) to install several field-scale HMBFs at selected oil well and battery sites in partnership with oil and gas operators to oxidize non-conserved volumes of solution gas (or the "associated gas" or "stranded gas" from crude oil production, and the technical term used by AER in Directive 60 to describe gas associated with crude oil) that are insufficient to support stable combustion; (3) and to demonstrate the viability of using HMBFs to control CH4 emissions associated with oil and gas industry operations. The successful demonstration will result in a commercial-ready product for the oil and gas sector. Methane emissions from Alberta's oil and gas sector were 31.4 megatonnes of C02-eq in 2014, and 48% of these emissions were from direct venting of solution gas. Although some of the gas is currently treated by thermal methods such as flaring (which produces toxic by-products) or incineration (which is expensive and has limited use), the oil and gas industry is seeking to leverage new technologies to reduce CH4 emissions in an environmentally-friendly and cost-effective manner. HMBFs do not produce harmful by-products, are cost-effective, simple to construct and operate, require minimal operator attention, and are maintenance free; MBF technology is, therefore, ideal for this application.

GHG EMISSION REDUCTION SUMMARY: