Executive Summary

Petroleum Technology Alliance Canada (PTAC) and the Alberta Upstream Petroleum Research Fund (AUPRF) engaged Process Ecology Inc. to undertake a study of the methane reduction abatement potential from glycol-based natural gas dehydration and refrigeration processes in the Canadian upstream oil & gas (UOG) sector.

The objectives of this work included the evaluation of alternative emissions estimation methodologies, determination of the key operating parameters that influence methane emissions, and identification of emissions reduction technologies applicable to these process units and their associated marginal abatement cost. The study involved a review of both glycol dehydration units (typically using triethylene glycol- TEG) and refrigeration plants (using ethylene glycol- EG). Primary data collection from UOG companies/facilities as well as secondary data collection from a number of other sources were used to inform the study results, including total installed costs and market penetration of emissions control technologies.

Key findings of the study include:

- The most widely used simulation software tools (Aspen HYSYS and GRI Glycalc) provide very similar predictions of methane emissions from these facilities. Some advantages were identified for the later versions of Aspen HYSYS (v9.0, 10.0) where the simulation model predicts dry gas water content with better accuracy than GRI GlyCalc. The "Glycol Property Package" in HYSYS has been identified as the best thermodynamics model to represent the TEG dehydration system. A modified "NRTL-Peng Robinson Property Package" in HYSYS has been determined as the best thermodynamic method to estimate emissions from EG refrigeration plants.
- Regarding the influence of operating parameters on methane emissions, for TEG dehydration plants, plant configuration characteristics such as the use of stripping gas and gas-driven pumps will significantly influence methane emissions. Parameters such as contactor temperature and pressure also influence methane emissions, although these parameters are generally not in the control of the operator. In general, facilities have control over glycol circulation rates (including changing the pump type/size), and the rate of stripping gas use. These key parameters can guide the implementation of control technologies for higher-pressure systems with gas driven pumps and stripping gas use, as these will be the largest emitters.
- It has been estimated that the potential for methane emissions reductions from glycol dehydration facilities in Western Canada is approximately 1.1 MT CO_2eq/yr and that these reductions can be achieved with low cost actions to reduce methane venting such as stripping gas reduction, glycol circulation optimization, and glycol pump replacements.
- Further emissions reductions can be achieved through the implementation of emissions control technologies. There are several control technologies available in the market. The choice of technology depends heavily on the specific characteristics of the facility including the availability of flare capacity, size of the operation, and other regulatory constraints.

- Process optimization methods such as circulation rate reduction, stripping gas reduction, and reboiler temperature optimization present opportunities for simultaneous emissions and cost reductions. These methods can be considered before technology installations which typically come with significant capital costs.
- Methane reduction potential and annualized costs were assessed for various technologies based on vendor estimates and actual installation experience in industry. Proprietary technologies that offer significant methane reduction at relatively low costs include vent gas capture which replaces fuel gas in the reboiler burner; however, care must be taken to ensure there is balance between available capture gas and reboiler burner requirements.