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A numerical investigation using Large scale eddy simulation of the burning characteristics of ultralow methane concentration flows.

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Methane is a greenhouse gas with a global warming potential that varies over the atmospheric residency time. According to the IPCC, upon release to the atmosphere and using a reference value of unity for carbon dioxide, the GWP is initially 56 over the first 20 years, 21 over 100 years and 6.5 over a 500 year timeframe. It is evident that any reduction in the atmospherically dispersed methane would beneficially contribute to reducing the increase of the global atmospheric temperature; especially in the Arctic, which increases at a substantially faster rate than the global average. A brief review of the existing methane mitigation technology is provided to compare to the VamTurBurner© a new technology. A numerical computation study of the combustion dynamics, using Large-eddy simulation, of the reacting co-flow field is presented. The study of a combustion-based greenhouse gas mitigation system to reduce the emissions of methane contained in ventilation air methane is presented. The numerical modeling demonstrates that, due to the ultralow methane concentrations in the ventilation airflow, preheating of the flow is critical to the combustion of methane in the ventilation air. The effects of preheating and methane concentration are examined in six computational cases of varying methane concentration from 0.5% to 3%. The results indicate that the oxidation and ignition of the ventilation air methane can take place in a co-annular jet configuration provided the preheating temperature is as high as 500 K for mixtures containing 0.5% methane concentration and as low as 400 K for methane concentrations up to 3%. It is concluded that ignition and combustion of ultralow methane flows can be controlled by providing the appropriate level of preheating. A computational flow dynamics study of the design is presented to demonstrate the feasibility of the VamTurBurner© operating at a typical flow rate of 100 m3/s.

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