Greenhouse Gas Analysis in Biosolids Management

Global warming is a widely known contributor to climate change. Climate change is the result of changes in the overall global temperature. Greenhouse gases (GHGs) are one of the main causes of global warming, as these gases build up in the atmosphere and retain heat.

Industries, government agencies, and non-government organizations are developing and improving initiatives to reduce GHG emissions. For example, in Alberta the Government of Alberta passed the Climate Change and Emissions Management Act and developed a carbon trading market (Alberta Offset System) to reduce its emissions.

These initiatives have driven the need to better quantify GHG emissions (and reductions) from various systems and processes, such as from energy, industrial, agricultural, and even in waste management. This need is to ensure GHG emissions and reductions are real and quantifiable, but more importantly withstand the stringent, robust, and rigorous scrutiny from a verifying and validation perspective.

The Edmonton Waste Management Centre of Excellence (EWMCE) and the University of Alberta partnered with the City of Edmonton – Drainage Services and Waste Management Services, to investigate current quantifying methods for GHG emissions from changes in biosolids management practices. The investigation involved evaluating the Biosolids Emissions Assessment Model (BEAM) by conducting a GHG analysis for the City of Edmonton's facility. The BEAM is a GHG model developed based on 9 Canadian municipalities – their processing facility and reuse programs – as well as literature values. The BEAM uses GHG accounting principles and protocols, such as life cycle assessment, and covers 12 unit processes. The model has been adopted by the Canadian Council of Ministers of the Environment.

Overall, this investigation found that the BEAM was an excellent tool at determining GHG emissions. Seven different biosolids reuse and/or end-use practices were determined, using City of Edmonton current system (i.e. processes and data) as well as some hypothetical processes. The order of emissions

(from least to highest) was: agricultural land application < non-agricultural land application < lagoon storage < biosolids cake storage < composting < thermal energy < landfill disposal.

However, the process of determining GHG emissions was complicated due to lack of available site-specific data. For example, there were some uncertainties when calculating lagoon storage emissions due to limited information on BOD_5 (biochemical oxygen demand for 5-days) of the biosolids. In the case of the City of Edmonton, the only available information was total organic carbon (TOC). According to literature, the conversion of BOD_5/TOC could range from 0.5 to 2.0, which means the GHG estimate has a relatively high range and uncertainty.

This uncertainty may not be within the assurance level for verification and validation purposes in some GHG regulations and carbon credit markets. Therefore, in order to obtain more accurate emission estimates for biosolids reuse practices, further model assessments are needed. But more importantly a robust data management collection system is vital for GHG purpose contact EWMCE for more information.

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