

# Mitigation strategies for Ammonia, GHG and odorous emissions from stored liquid manure: a microbial approach.

## Summary for Policymakers

## ABOUT THIS REPORT

This report originates from a scientific paper published in the journal "Sustainability" (<https://www.mdpi.com/2071-1050/12/4/1393>) in February 2020 by a globally recognised climate emissions team at the University of California, Davis, lead by prof. Frank Mitloehner. The purpose of the study was to evaluate the real world efficacy of "SOP LAGOON," a commercial manure additive developed to improve the sustainability parameters for dairy operations worldwide and to mitigate the Greenhouse Gases (GHG), ammonia and unpleasant odor emissions by conditioning microbial activities in manure management.



## THE BACKGROUND

Ammonia (NH<sub>3</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and carbon dioxide (CO<sub>2</sub>) emissions from livestock farms contribute to negative environmental impacts, such as soil and water acidification and climate change. Ammonia emissions (over 80% of which come from manure handling) are a known criteria pollutant that affects human health, and has been recognized by the scientific community as an essential precursor to PM<sub>2.5</sub> formation. According to the IPCC, agriculture worldwide contributes 10% to 12% of anthropogenic CO<sub>2</sub>, 40% of CH<sub>4</sub>, and 60% of N<sub>2</sub>O emissions. Some of the manure management practices that seek to reduce these kinds of emissions require significant capital investment and high maintenance costs. Therefore, alternative approaches are often sought, such as the use of additives in slurry storage. A previous study of Borgonovo et al, published in Sustainability in September 2019 (<https://www.mdpi.com/2071-1050/11/18/4998>), demonstrated that SOP LAGOON is effective in mitigating GHG and ammonia emissions from fresh slurry.

## THE STUDY

The study was performed on separated liquid manure, sourced from a commercial dairy farm (900 head, Solano County, CA) which is representative of typical dairy operations. Ammonia (NH<sub>3</sub>), Greenhouse gases (GHG), and odorous emissions were measured over time to assess the potential impact of SOP LAGOON for emissions mitigation at source in manure management. The measurements were made continuously over a one week period to evaluate the fluctuations of the emissions streams along with daily moisture and temperature.

## THE RESULTS UPON GASEOUS AND ODOROUS EMISSIONS

The liquid manure treated with the SOP LAGOON additive showed significantly lower emission levels across the entire measured period:

- **Ammonia (NH<sub>3</sub>) reduced by 45.9%**
- **Methane (CH<sub>4</sub>) reduced by 22.7%**
- **Nitrous Oxide (N<sub>2</sub>O) reduced by 45.4%**
- **Carbon Dioxide (CO<sub>2</sub>) reduced by 14.7%**

The use of SOP LAGOON also significantly **reduces odor intensity**.

## SOP LAGOON AND THE UN SUSTAINABLE DEVELOPMENT GOALS (SDGS)

Due to the gaseous emissions reductions and the life cycle assessment (as in Borgonovo et al.), the integration of SOP LAGOON into the UN SDG framework for a more sustainable world is recognized and encouraged, especially for SDG3 (Health and Well-being), SDG6 (Water quality) and SDG13 (Climate action). The ability of SOP LAGOON to reduce odorous emissions also allows the farms to mitigate their impact on potential conflicts with the surrounding communities, improving their compliance with SDG11 (Sustainable communities) and SDG17 (Partnership for the goals).

## THE UC DAVIS RESEARCH TEAM

Prof. Dr. Frank Mitloehner, PhD, is Professor and Air Quality Extension Specialist, Department of Animal Science at University of California - Davis. He served as Chairman at FAO for the Partnership Project for the Benchmarking of Environmental Impacts of the Global Livestock Supply Chains, LEAP. His team's research areas include measurements and mitigation of greenhouse gases, ammonia, and the study of their effects on human- and animal health and welfare, investigating the nexus of agricultural productivity and environmental sustainability.

## THE SOP PRODUCT

SOP LAGOON is a commercial additive for liquid manure, on the market for over 15 years in the EU and North America, based on Calcium Sulfate dihydrate, and processed with a proprietary technology. The SOP technical process is designed to work positively with the microbial communities present in liquid manure to achieve better environmental outcomes for farmers, their communities, and the planet. The primary commercial goals of SOP LAGOON are to reduce energy consumption on farm by maintaining manure fluidity, to reduce strong odors, and to mitigate gaseous emissions, such as ammonia, for improved farm productivity on a lower cost basis.



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