

Mitigation strategies  
for Ammonia and GHG 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/2071-1050/11/18/4998>) in September 2019 by a leading environmental and climate emissions team at the University of Milan. 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 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 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. SOP LAGOON was also tested by prof. Mitloehner and his team at UC Davis, showing significant results in mitigating the ammonia, GHG and odor emissions from separated liquid manure (Petersen et al., Sustainability, February 2020, <https://www.mdpi.com/2071-1050/12/4/1393>)

## THE STUDY

The study was performed on fresh liquid manure, sourced from a commercial dairy farm which is representative of typical dairy operations. Ammonia (NH<sub>3</sub>) emissions and Greenhouse gases (GHG), as well as the chemical characteristics of the liquid manure, were measured over time to assess the potential impact of SOP LAGOON for emissions mitigation at source in manure management. A Life Cycle Assessment (LCA) of SOP treated liquid manure was also performed in order to evaluate the results within an whole system approach, including the impact of using liquid manure as crop fertilizer.

## THE RESULTS UPON GASEOUS EMISSIONS

The manure treated with the SOP LAGOON additive showed significantly lower emission levels starting from day 4 after the first application in the manure:

- **Ammonia (NH<sub>3</sub>) reduced by 100%**
- **Methane (CH<sub>4</sub>) reduced by 21.5%**
- **Nitrous Oxide (N<sub>2</sub>O) reduced by 100%**
- **Carbon Dioxide (CO<sub>2</sub>) reduced by 22.9%**

## THE RESULTS FROM THE LIFE CYCLE ASSESSMENT

Two life cycle scenarios were compared, one with and one without the addition of SOP LAGOON. The Alternative Scenario, i.e. the scenario with the addition of the product, proved to be the most effective with the greatest results in the Climate Change Mitigation, Particulate Matter Formation, and Terrestrial Impact categories, as the product reduces gaseous emissions without accumulating nitrates in the slurry, thus making it a valid and valuable substitute for synthetic fertilizers. Due to the emissions reductions and the life cycle assessment, the desire to integrate SOP LAGOON into the UN SDG framework for a more sustainable world is recognized and encouraged, especially for SDG6 and SDG13.

## THE UNIVERSITY OF MILAN RESEARCH TEAM

Prof. Dr. Marcella Guarino, PhD, is Associate professor at University of Milan, in the Department of Environmental Science and Policy. She is Chairperson at the European Association of Precision Livestock Farming. Her team's research areas include monitoring air emissions from farms and the identification of techniques and strategies to reduce the impact of livestock operations on the environment.

## 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 dehydrate, 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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