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GHG measurement for manure management of Livestock

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Present manure management really managed manure ?

Reduce the environmental impact for neighbor,

air (malodor, dust) ,

public water (N,P and pathogen pollution).....

But not enough for GHG

...new issue.

In this presentation

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Introduce our activity concerning manure GHG

- **Manure management in Japan**
  - Typical in monsoon Asian countries
  - 4 major types of management
  - Composting play a central role
- **GHG evaluation systems**
  - **Emission factor (gCH_4/gOM,gN_2O-N/g N) of each management fluctuate**
  - Depend on env. condition, those factor change widely
- **Reduction, Yes we can**
  - Low protein feed usage
  - Control of Oxi./Red. condition
  - Realizing of Microorganisms

GHG generate How ? & Where?

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Manure storage tank

Oxidizing of CH_4 ?

5-10cm surface layer

N_2O

Nitrification & Denitrification of Nitrogen

Nitri. $NH_4^+ \rightarrow NH_2OH \rightarrow NO_2^- \rightarrow NO_3^-$

Denitri. $NO_3^- \rightarrow NO_2^- \rightarrow NO \rightarrow N_2O \Rightarrow N_2$

Under 15 cm depth (ORP under -100 ~ -200mV)

Anaerobic degradation of OM in manure

CH_4

Acetic acid $CH_3CO_2H \rightarrow CH_4 + CO_2$

Formic acid $4HCO_2H \rightarrow CH_4 + 3CO_2 + 2H_2O$

Methanol $4HCO_3OH \rightarrow 3CH_4 + CO_2 + 2H_2O$

Treatment of livestock waste in Japan (N flow)

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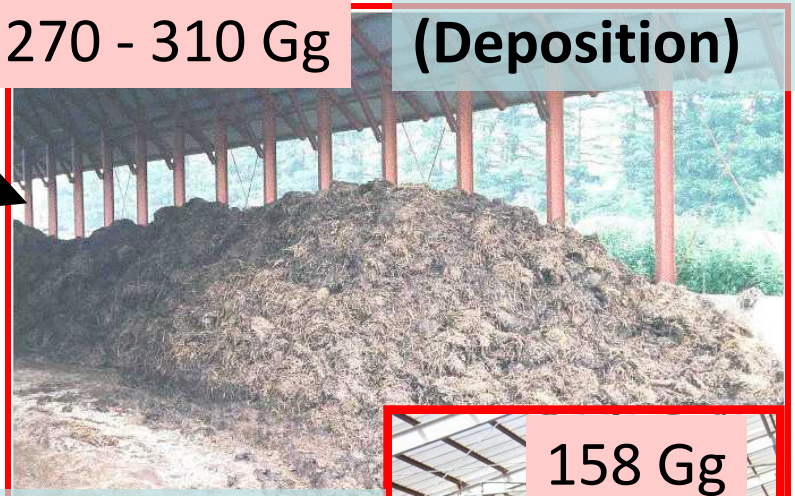
Livestock housing (658 Gg/y of N)

Solid part

270 - 310 Gg

Piled compost (Deposition)



Composting

158 Gg

Forced aeration (Mechanical turn)

(Dry, Incineration ….)

Liquid part

37Gg

Pit storage & spread

95 Gg

Wastewater purification

Calculation of GHG emission from composting

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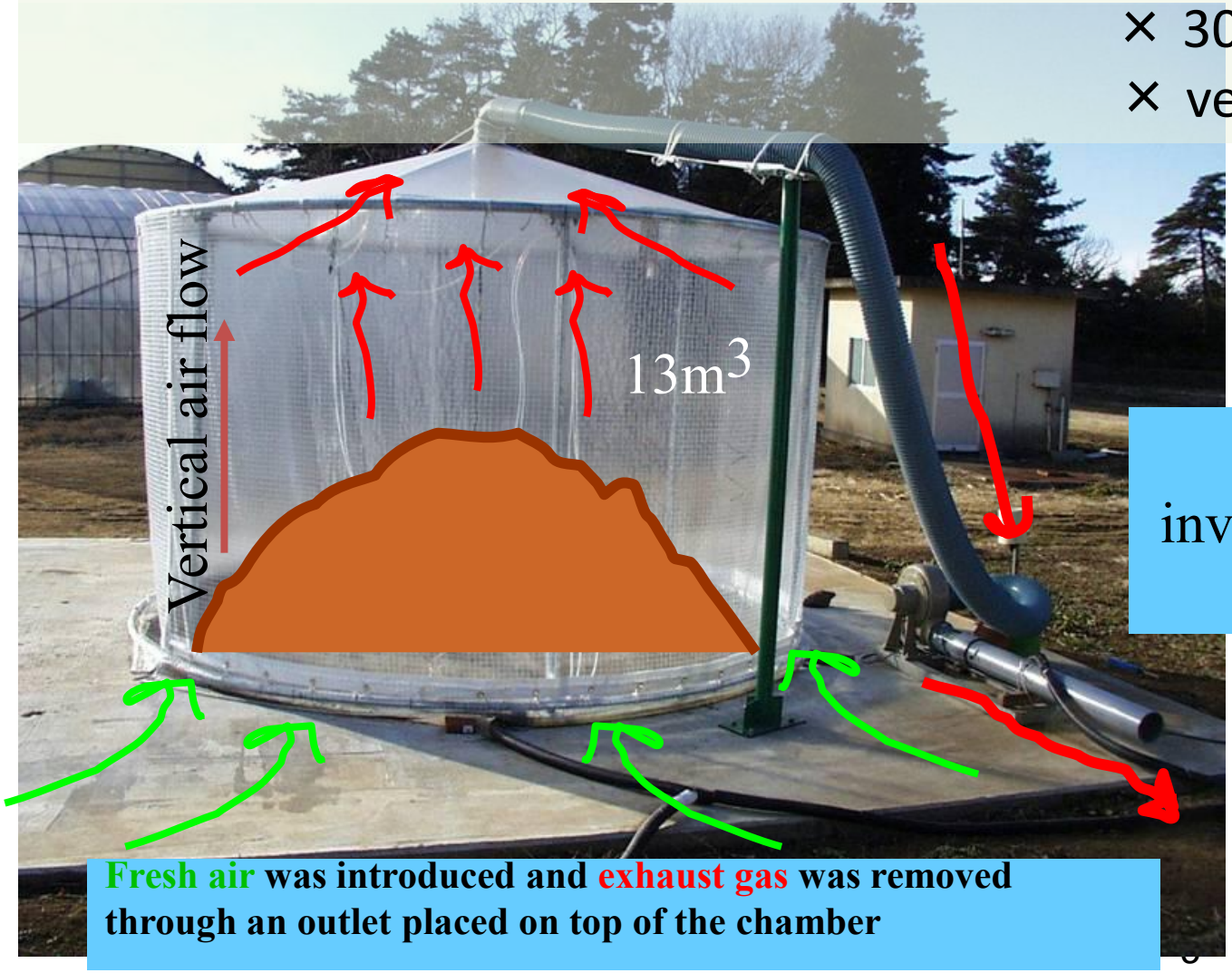
E (mg/30 min) =

(conc. of outlet air (mg/m^3) – conc. of inlet air (mg/m^3)

× 30(min)/60(min)

× ventilation rate (m^3/h)



Draw by an inverter-controlled blower.

130m^3/hour

Fresh air was introduced and exhaust gas was removed through an outlet placed on top of the chamber

Measurement system for Piled Composting (Depo.)

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dairy cattle feces

Calculation of GHG emission from composting

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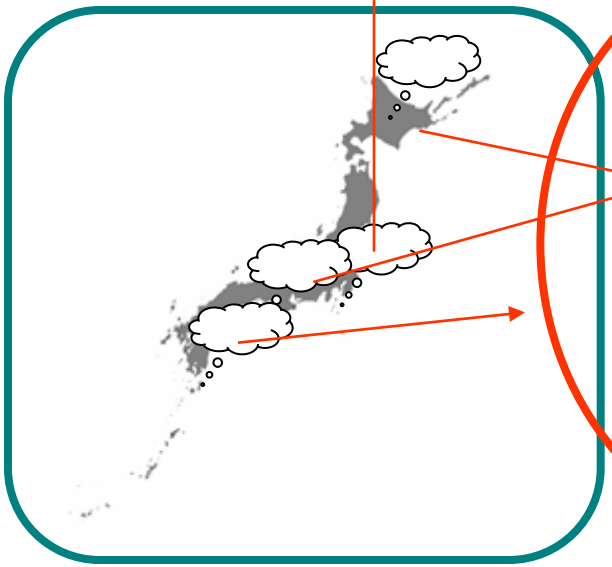
We are going to measure GHG at several location of Japan with this system.



温室効果ガス測定チャンバー稼働中です！

家畜ふん尿起源の環境負荷ガスを減らすため、畜産草地研究所と３つの研究機関が共同研究中です（温暖化イニシアチブ）。

Measurement system for Composting (Forced)

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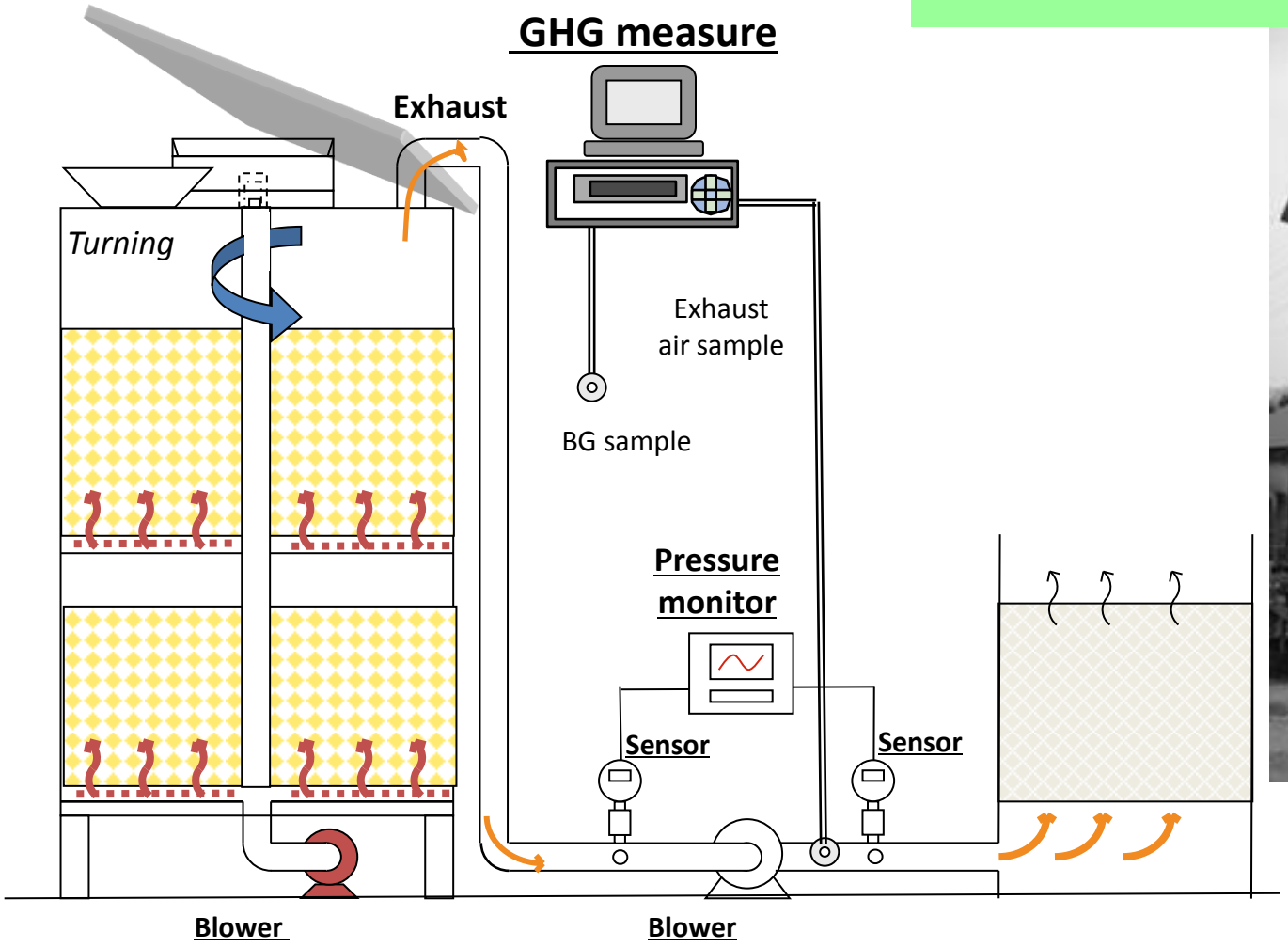
hens feces



Measurement system for Wastewater purification

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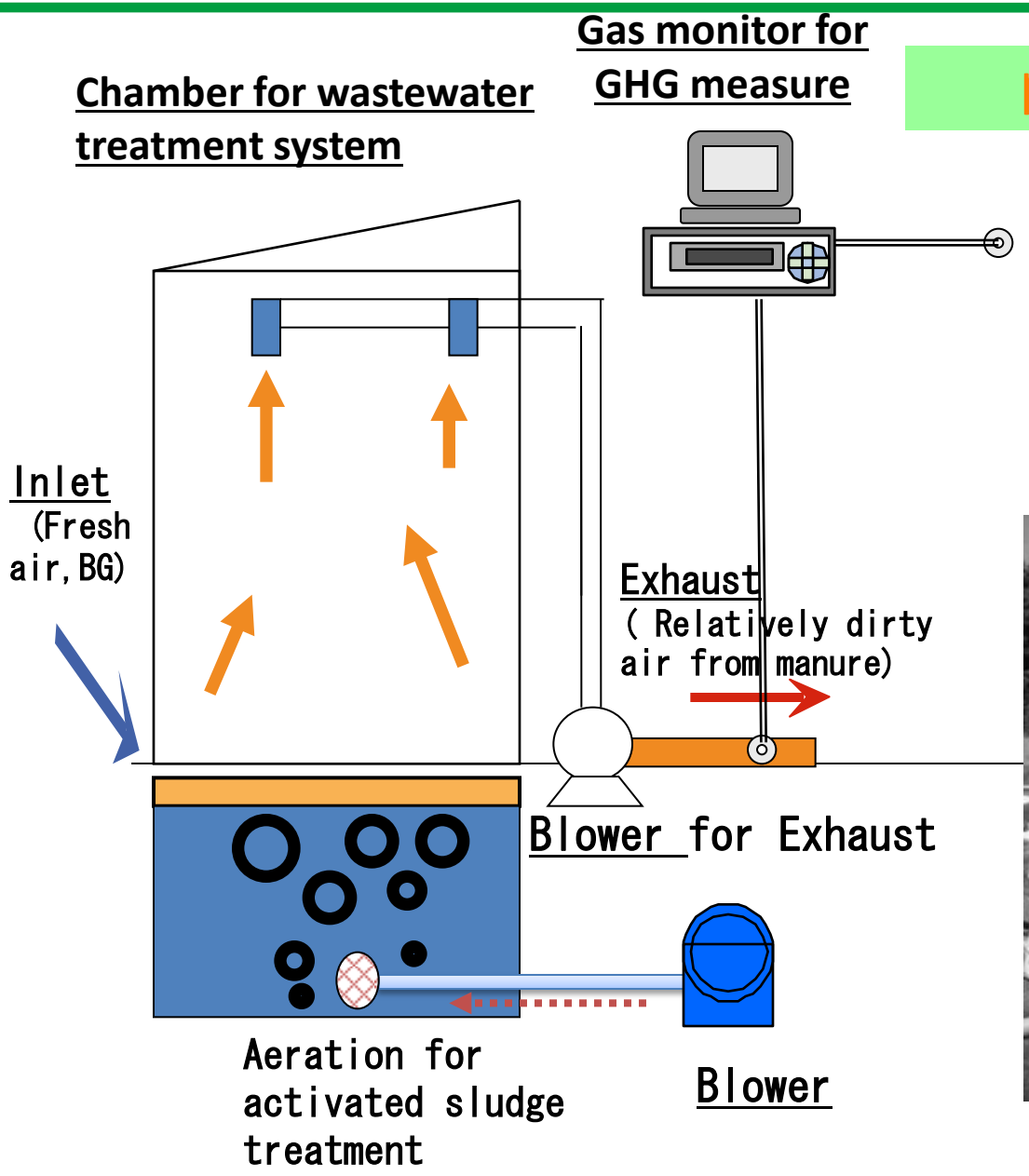
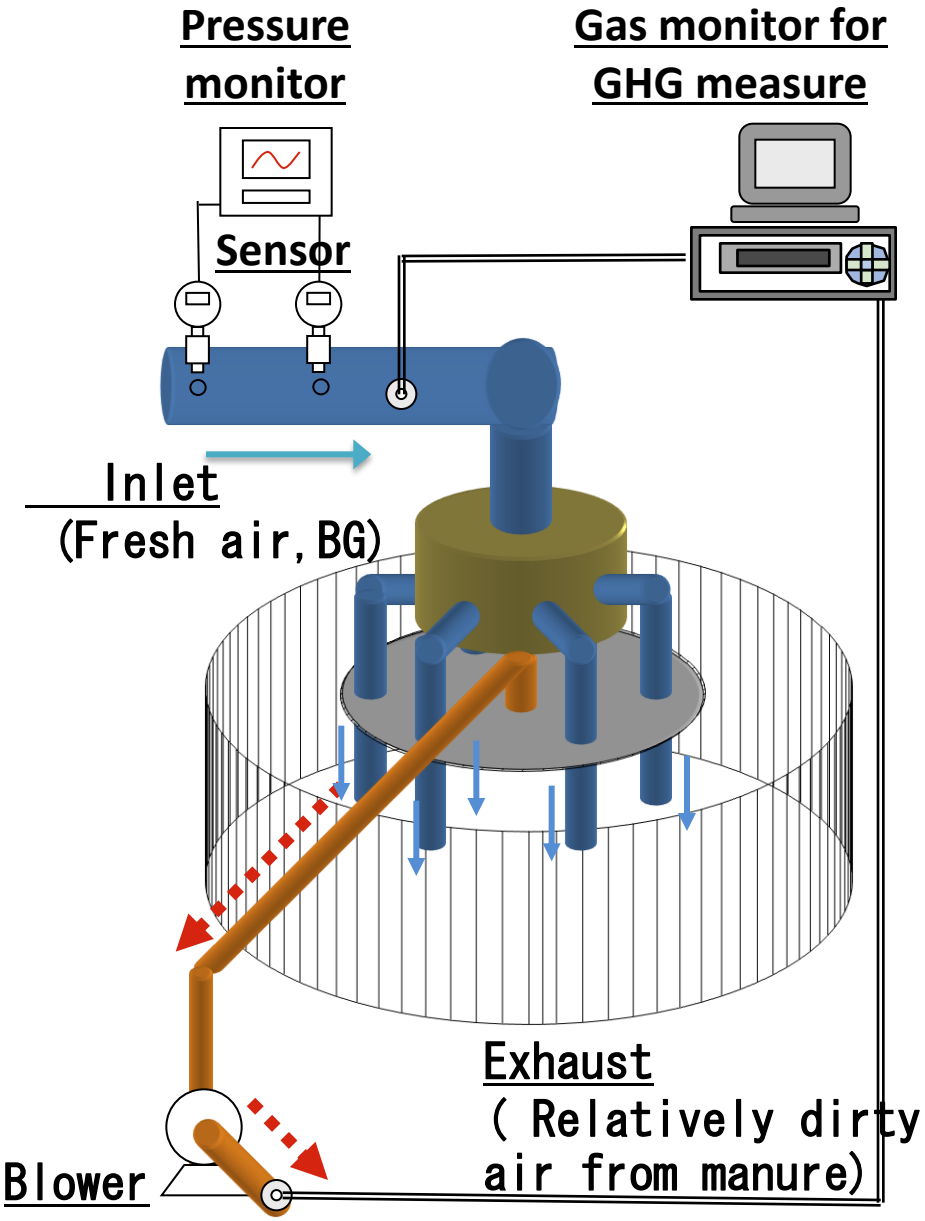
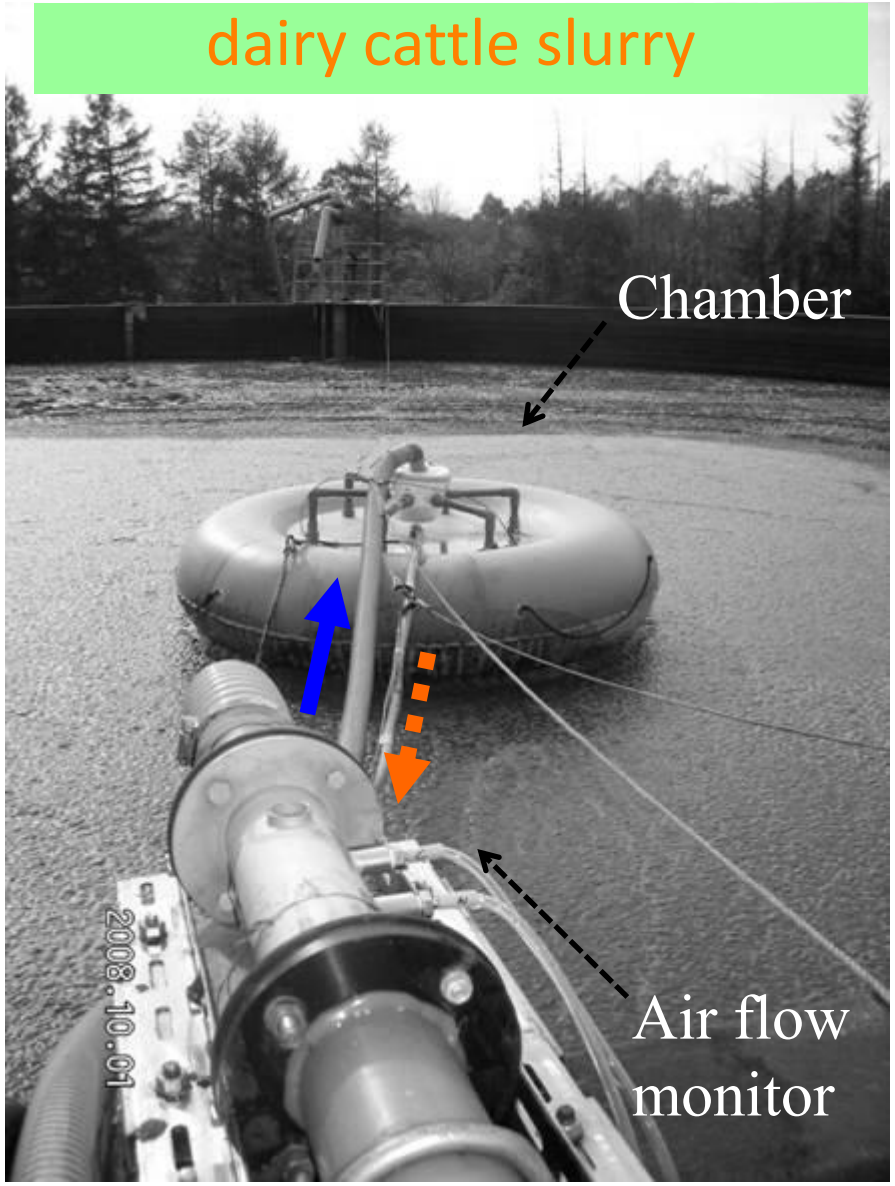
pig or dairy wastewater



Measurement system for Pit Storage





Measurement result of Slurry storage

Storage Tank: 23m diameter / 4.5m depth

Store 150 heads of milking cow slurry around 180 days

20kg of CH_4 & a few N_2O emit./day

Conclusion＆Opinion

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Animal products are **important source of protein, medicines and clothing,** but the implementation of GHG mitigation measures were required for all farmers.

We developed **a system for the quantitative measurement of emissions** from major manure treatment systems using a large dynamic chamber. It is important tool for National Inventory, and for **developing new GHG regulation technology** .

The **emission factor** of each treatment system should be evaluated under each countries procedure and general conditions, because those **factors might be widely varied.**