Study on CH_4 Emission and Reduction Potential in Waste Treatment of China

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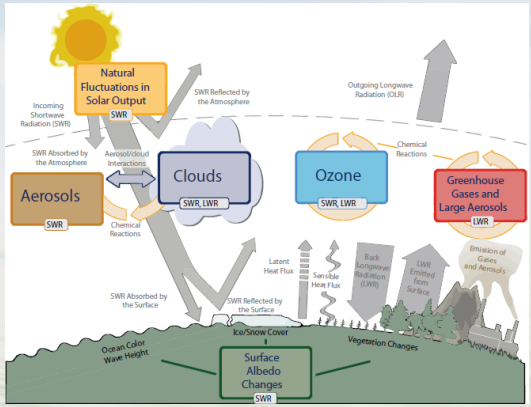


Background

Grants Funded

- GEF
- UNDP

National Communication

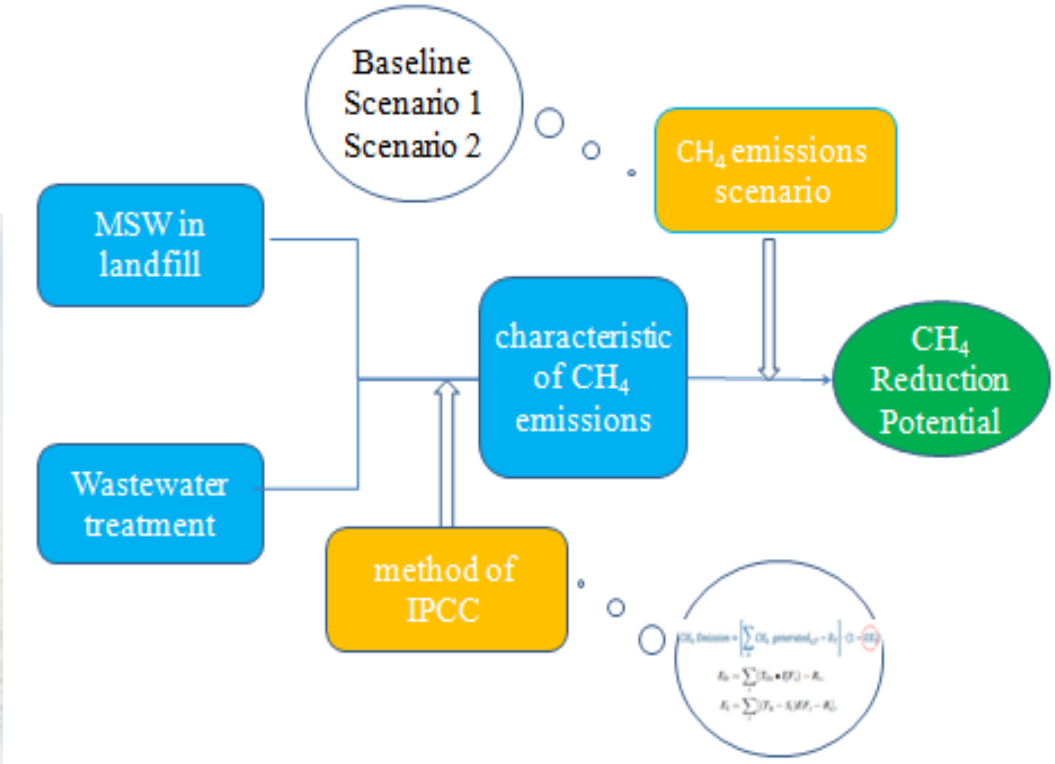
- INC
- SNC
- TNC

Subcontract 6 waste sector

- MSW landfill
- Wastewater
- Waste incineration
- Waste biochemical treatment

Methods and Data

☑ Framework and steps



Methods and Data

☑ Calculation of CH_4 emissions

The methodology used to estimate CH_4 emissions was obtained from

- **The IPCC Revised Guidelines for National Greenhouse Gases Inventory （IPCC, 1996 Guidelines)**
- **The IPCC Good Practice Guidance and Uncertainty Management in National greenhouse(IPCC, GPG 2000).**
- **The 2006IPCC Guidelines for National Greenhouse Gases Inventory is cited as a reference during the calculation (IPCC, 2006 Guidelines).**

Landfill:

$$CH_4\ Emission = \left[\sum_x CH_4\ generated_{x,T} - R_T\right] \cdot (1 - OX_T)$$

Domestic:

$$E_D = \sum_i (T_{Di} \bullet EF_i) - R_i,$$

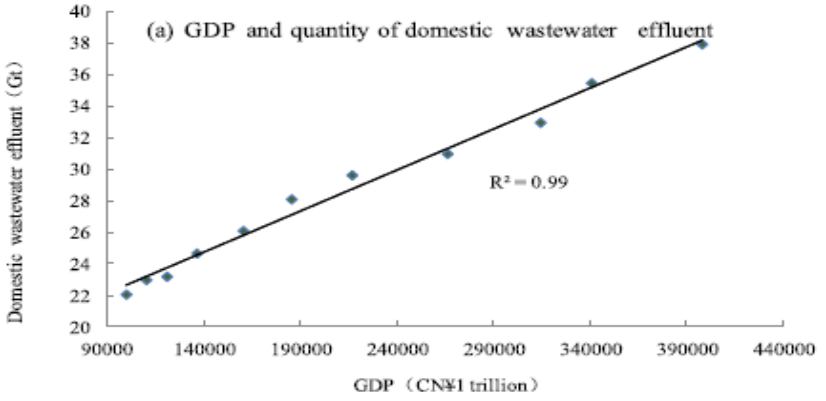
Industry:

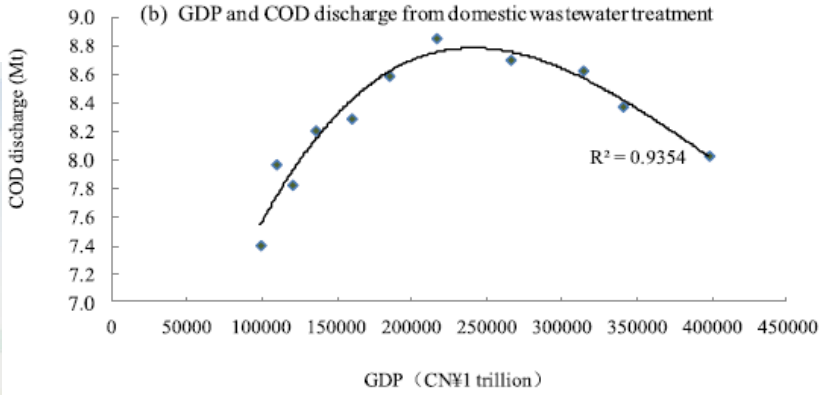
$$E_I = \sum_i [(T_{Ii} - S_i)EF_i - R_i],$$

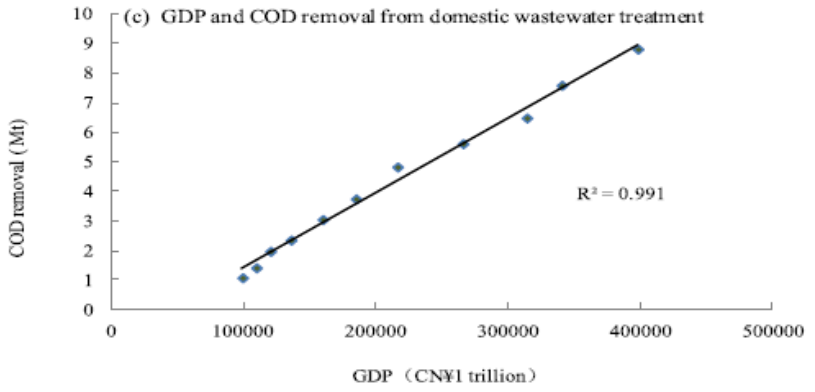
Methods and Data

☑ Scenario analysis method

- **Economic development and improvement of people's living conditions promotes an increase in MSW and wastewater activity data**
- **The relevant characteristic data and GDP data on MSW and wastewater treatment from 2000 to 2010 is used to analyze the relationship.**







Methods and Data

☑ Baseline Scenario analysis method

- **Based on the literature GDP growth rate is predicted to be between 7% and 12%. (He, 2012;Guo and He, 2014; Pan, 2014; Liang et al., 2013)**
- **Based on State policies, China‘s economy is predicted to grow between 7% and 9%**
- **In this research, the GDP prediction is based on China's GDP from 2000 to 2012.**
- **The growth rate of GDP is set as 7% prior to 2015 and 6% after.**

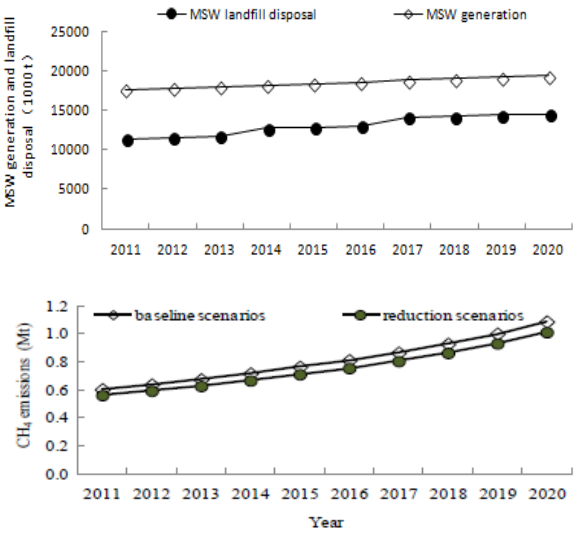


Fig. 7. China's CH_4 emissions under baseline and reduction scenarios from domestic wastewater.

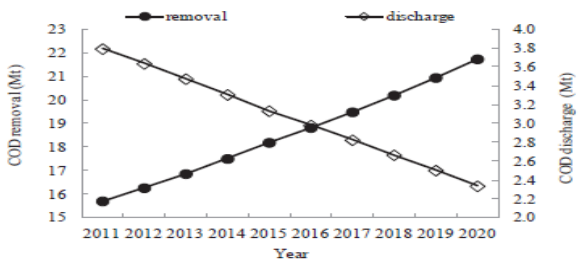


Fig. 8. Projected COD discharges and removal from industrial wastewater.

Methods and Data

☑ Reduction Scenario analysis method

by 2020, CH_4 emission reduction from MSW landfill disposal will be

- **A:CH_4 recycling 5%**
- **B:CH_4 recycling 5% and DOC_f=0.5**

Emission reduction scenario	Assumptions	Evidences
Scenario A	5% of domestic municipal solid waste landfill using landfill gas torch combustion or other recycling methods.	Municipal solid waste landfill pollution control standard is GB16889-2008; Annual total emission reduction of CDM project of landfill gas recovery and utilization in municipal solid waste landfill.
Scenario B	The ratio of emission factors to degradable organic carbon (DOC_f) was 0.5.	Present value is 0.6, With the improvement of the garbage classification level in our country, comprehensive utilization of landfill and incineration, the policy effect of garbage source classification is further enhanced and more choices for composting and incineration, the DOC_f ratio will be reduced in the future.
	5% of domestic municipal solid waste landfill using landfill gas torch combustion or other recycling methods.	Municipal solid waste landfill pollution control standard is GB16889-2008; Annual total emission reduction of CDM project of landfill gas recovery and utilization in municipal solid waste landfill.

Methods and Data

☑ Reduction Scenario analysis method

by 2020, CH_4 emission reduction will be

- **domestic wastewater treatment： 7%**
- **industrial wastewater treatment ： 10%**

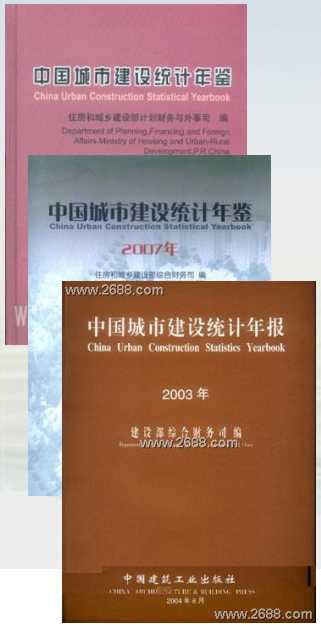
CH_4 emissions from domestic wastewater treatment under reduction scenario and reduction potential.

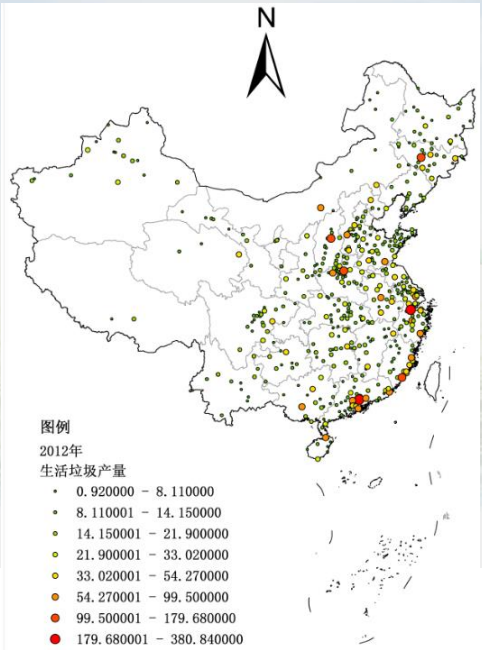
Emission reduction technology	Emission reduction control policy	CH_4 emission reduction
Control the aerobic reaction percentage	Design and construction standard of urban wastewater treatment plant engineering project	7%
Anaerobic system with CH_4 recycling and combustion treatment function	Best feasible technology guide for prevention and governance of sludge treatment and disposal of city and town wastewater treatment plants	
CH_4 recycling and utilization in sludge anaerobic assimilation	Notification of ministry of finance and state taxation administration on comprehensive resource utilization and value-added tax policies of other products	

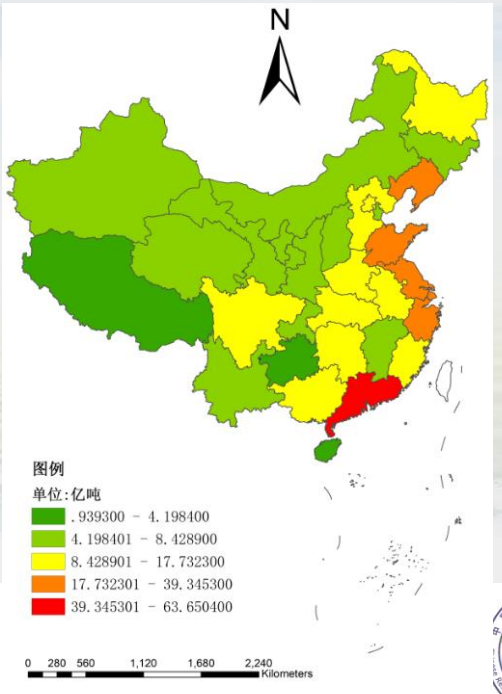
Methods and Data

☑ Data

- The main emission parameters for calculating according to the research results from China's Second National Greenhouse Gas Inventory (DCC, 2014).
- The activity data used comes from China Construction Statistics Yearbook (NBSC,2005-2010) and China Environment Statistics Yearbook(MEP, 2005-2012a,b).

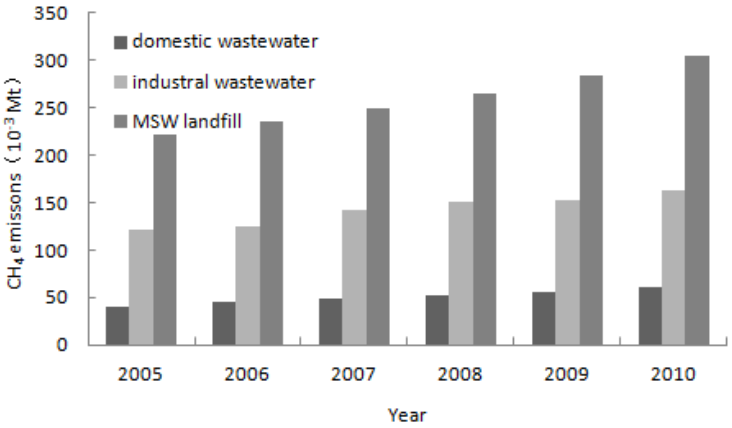






Results

- In China, CH_4 emissions from MSW landfill, domestic and industrial wastewater treatment respectively were 3.05Mt, 0.61 Mt and 1.62 Mt in 2010. CH_4 emissions increased annually from 2005 to 2010.



- CH_4 emissions from 8 industries such as paper-making and paper products industry accounted for 92% of the total industries.

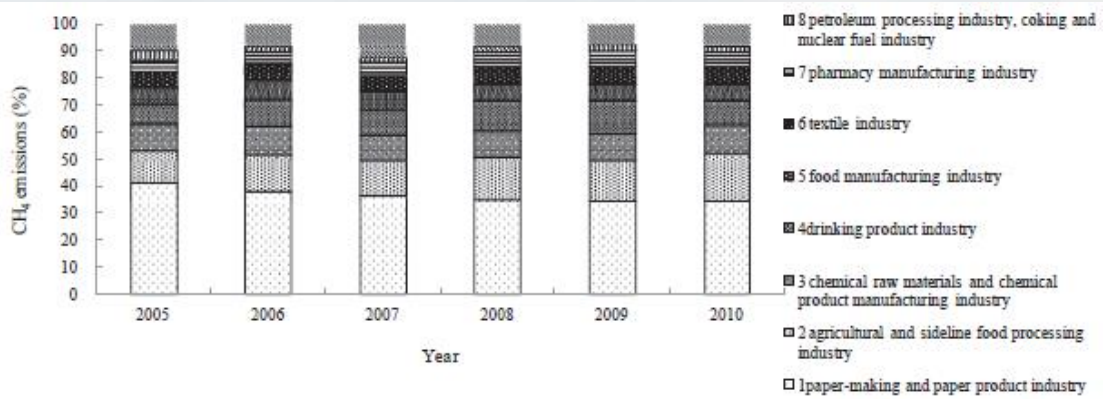
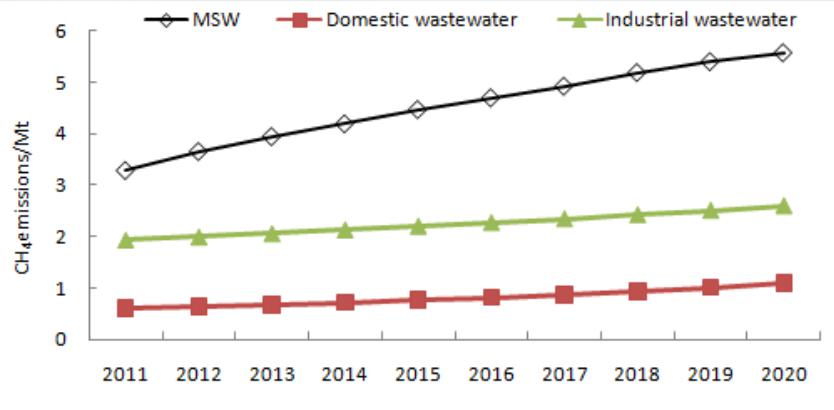


Fig. 4. CH_4 emissions from industrial wastewater in key industries from 2005 to 2010.

Results

In 2020, the emission baseline scenario, CH_4 emissions from:

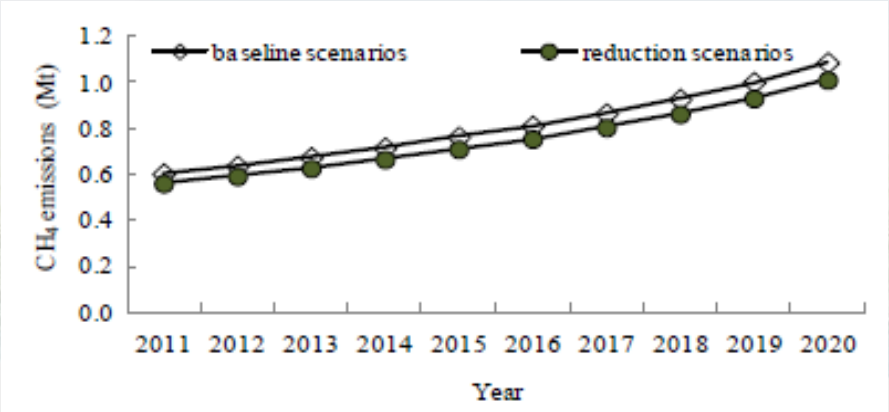
- **MSW landfill disposal: 5.59Mt,**
- **Domestic wastewater treatment : 1.09 Mt,**
- **Industrial wastewater treatment: 2.60 Mt,**
- **Respectively, resulting in an increase of 83%,78% and 60% compared to 2010.**



Results

In 2020, after the emission reduction, CH_4 emissions from:

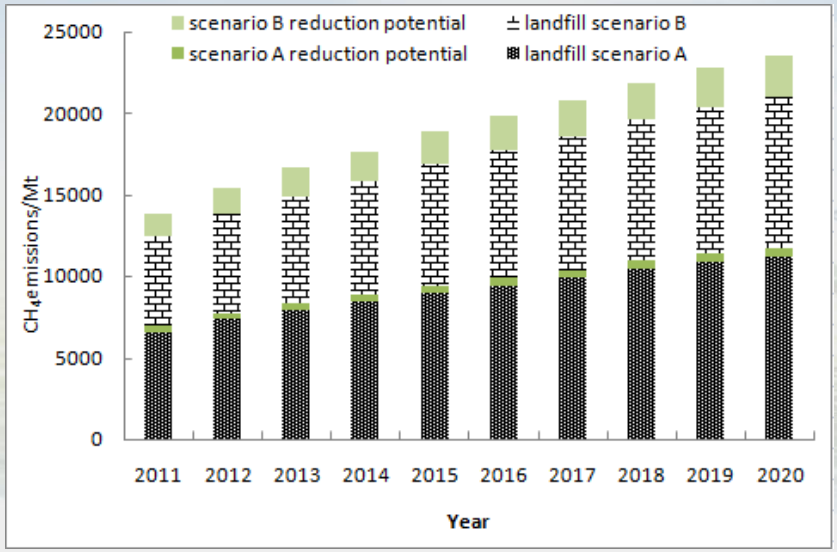
- **MSW landfill disposal: 5.3Mt(scenario A), 4.4Mt (scenario B);**
- **Domestic wastewater treatment :1.01 Mt ;**
- **Industrial wastewater treatment : 2.3Mt;**
- **Respectively, resulting in an increase of 74%, 45%, 66% and 44% compared to 2010.**

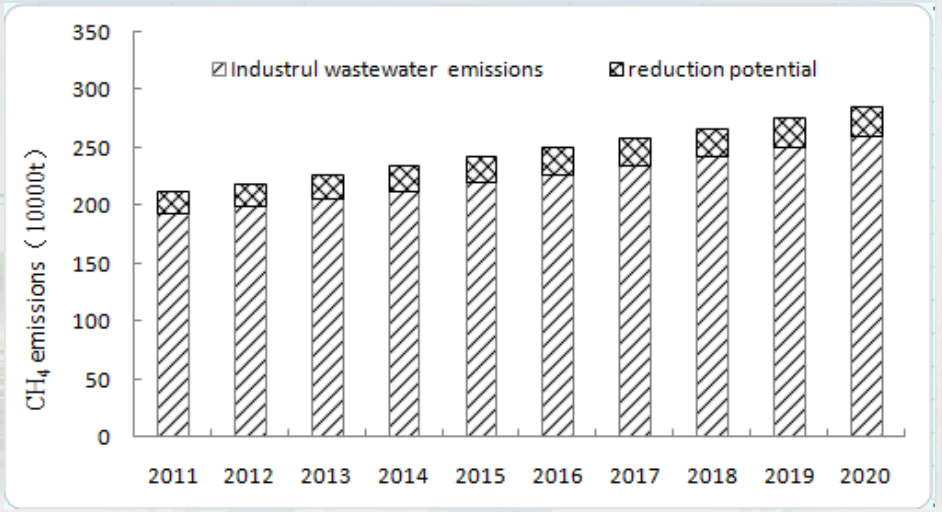


Results

Under the reduction scenario by 2020, the CH_4 emission reduction potential：

- **MSW landfill disposal： 0.28Mt (scenario A), 1.16Mt(scenario B);**
- **Domestic wastewater treatment ： 0.08Mt;**
- **Industrial wastewater treatment： 0.26Mt.**





Mitigation measures

☑ Waste sector

- To Promulgate a series of regulations, rules and standards
  - Measures on Household Waste Management in Cities
  - Promoting Industrialization of Municipal Sewage and Waste Treatment
- To formulate tax reduction or exemptions policies of waste treatment for power generation and utilization
- CDM project development: waste incineration power generation and recovery of landfill gas for power generation

Mitigation measures

☑ Waste sector

- Municipal waste treatment and disposal of technical policies and standards
  - Technical Standards for Civil Waste Landfill
  - The Standard on Burning of Civil Waste and Pollution Control
  - Discharge standard of pollutants for wastewater treatment plant
- Set up a payment system for waste discharge
- Accelerate reform of waste management system
- Introduce a competition mechanism
- Use biding, select qualified enterprises for MSW treatment

Mitigation measures

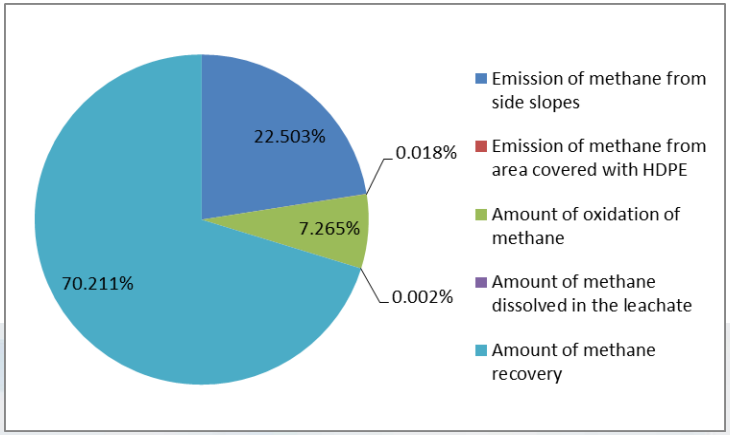
☑ Monitoring experiment at landfill

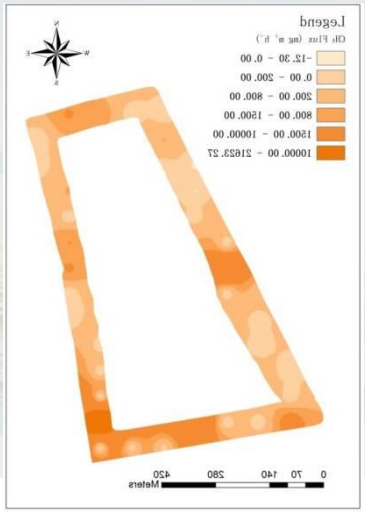
The last five years, in order to better understand the uncontrolled GHG emissions, a quantitative in-situ measurement and evaluation of methane (CH_4), carbon dioxide (CO_2) and nitrous oxide (N_2O) emissions were conducted at Asuwei landfill in Beijing, China.

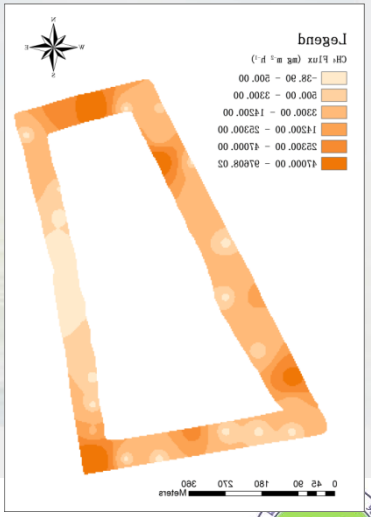
Mitigation measures

☑ Establish a perfect CH_4 recovery system

- Recycling is the main way to reduce CH_4 emissions
- According the geospatial analysis with Inverse Distance Weighting (IDW) methods, in summer, the area whose fluxes ranged from 200 to 800 mg CH_4 m^{-2} h^{-1} accounted for the largest proportion of the monitoring area (40%) while 3300-14200 mg CH_4 m^{-2} h^{-1} of fluxes accounted of the monitoring area (44%) in winter.



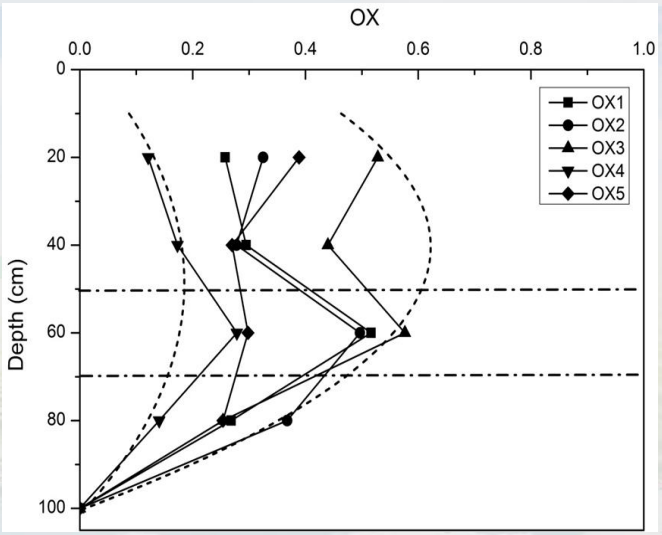




Mitigation measures

- ☑ **Increase the layer covering thickness of overlying soil**

According to the results determined by the ratio of CH_4/CO_2 in the soil cover, OX generally increases with depth. Especially, there is a sharp increase in the depth of 60 cm under the landfill soil cover.



Mitigation measures

- ☑ **Coverage high density polyethylene film in the non-operation surface in landfill**

Cooperate with the surface gathering pipeline makes the formation of negative pressure inside the membrane, is conducive to reducing CH_4 emissions.

Thanks
for your attention !

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