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5 - Waste Sector

12/11/2021

Sector 5 - Waste

- categories:
  - 5.A Solid waste disposal (sites)
  - 5.B Biological treatment of waste
  - 5.C Incineration and open burning of waste
  - 5.D Wastewater treatment
  - 5.E Other

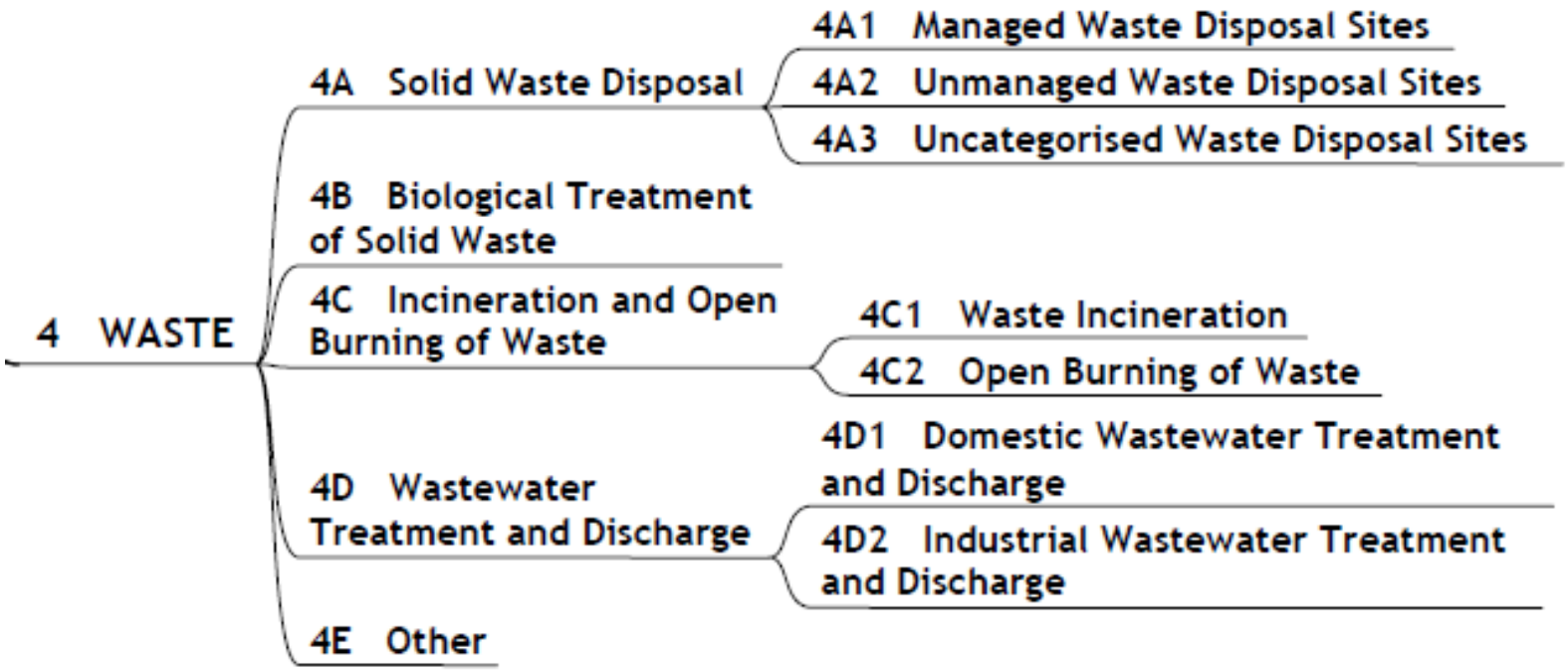

Fig. 1 Scheme of Waste sector from 2006 IPCC Guidelines for National Greenhouse gas Inventories

5.A Solid Waste Disposal

5.A Solid Waste Disposal	5.A.1 Managed Waste Disposal Sites	a. Anaerobic
		b. Semi-aerobic
	5.A.2 Unmanaged Waste Disposal Sites	
	5.A.3 Uncetogorised Waste Disposal Sites	

Data for 5.A

- Data on waste:
  - Czech Environmental Information Agency (CENIA) – Information System on Waste Management (ISOH)
  - Czech Statistical Office (CzSO) – reporting to Eurostat
- ISOH x CzSO data
- Data on MSW composition: EKO-KOM or case studies (municipalities, universities)
- Data on landfill gas use (Recovered methane): Ministry of Industry and Trade (MIT)

Data for 5.A

- Data on waste: database available since 2002 (ISOH); waste composition later (mixed sources in years)
- FOD model (calculation sheet from IPCC)
- Default emission factors

5.B Biological Treatment of Solid Waste

5.B Biological Treatment of Solid Waste	5.B.1 Composting	Municipal Solid Waste
		Other Waste
	5.B.2 Anaerobic digestion at biogas facilities	Municipal Solid Waste
		Other Waste

Data for 5.B

- Composting: Data on waste composted: CENIA – Information System on Waste Management (ISOH)
- Anaerobic Digestion: Data on biogas: Ministry of Industry and Trade (MIT)
  - Data on energy produced from the biogas
  - **energy** converted by **net calorific value** to **weight** of the fuel (biogas)
  - emissions = 5 % of weight (of CH_4 production)
- Default factors

5.C Incineration and Open Burning of Waste

5.C Incineration and Open Burning of Waste	5.C.1 Incineration	Biogenic
		Non-biogenic
	5.C.2 Open Burning of waste	Biogenic
		Non-biogenic

→ MSW
→ Other

MSW	
Other	Industrial Solid Waste
	Hazardous Waste
	Clinical Waste
	Sewage Sludge
	Fossil Liquid Waste (only non-biogenic)

Data for 5.C

- Data on waste incinerated: CENIA – ISOH, hazardous waste is part of all other categories
- Data on waste open-burned: new methodology for calculating the amount of waste open-burned
  - data from firefighters on waste fires
  - data on waste landfilled etc.: ISOH
  - data on MSW composition: EKO-KOM or case studies (municipalities, universities)
  - physical parametres from various sources
  - emissions from open-burning of waste under the reporting limit

Data and factors for 5.C.1

- Waste to energy in Energy sector
- Default emission factor except combustion efficiency

Tab. 1 Factors used in 5.C.1

	MSW	Clinical	Sewage sludge	Industrial (+ residues)
Carbon fraction	0.4	0.6	0.3	0.5
Fossil carbon fraction	0.3	0.4	0	0.9
Combustion efficiency	0.995	0.995	0.995	0.995
C-CO_2 ratio	3.7	3.7	3.7	3.7
Dry matter content	0.7	0.65	0.1	0.9
CH_4 emission factor [kt CH_4/kt waste]	2.0E-07	2.0E-07	9.7E-06	2.0E-07
N_2O emission factor [kt N_2O/kt waste]	5.0E-05	1.0E-04	9.0E-04	1.0E-04

5.C.2

- Landfill fires, bins and containers, heaps
- No household burning of waste – no statistics about it, huge uncertainty
- Default emission factors depending on waste composition (from IPCC 2006)

5.D Wastewater Treatment and Discharge

5.D Wastewater Treatment and Discharge	5.D.1 Domestic Wastewater
	5.D.2 Industrial Wastewater
	5.D.3 Other

Data for 5.D

- 5.D.1
  - CzSO: data on population, sewer connection, fraction on wastewater treated etc.
  - FAOSTAT: Protein consumption per capita
  - MIT: CH_4 recovery from anaerobic digestion of sewage sludge
- 5.D.2
  - CzSO: data on share of each industry and index of industrial production
  - MIT: CH_4 recovery from anaerobic digestion of sewage sludge

5.D.1 scheme

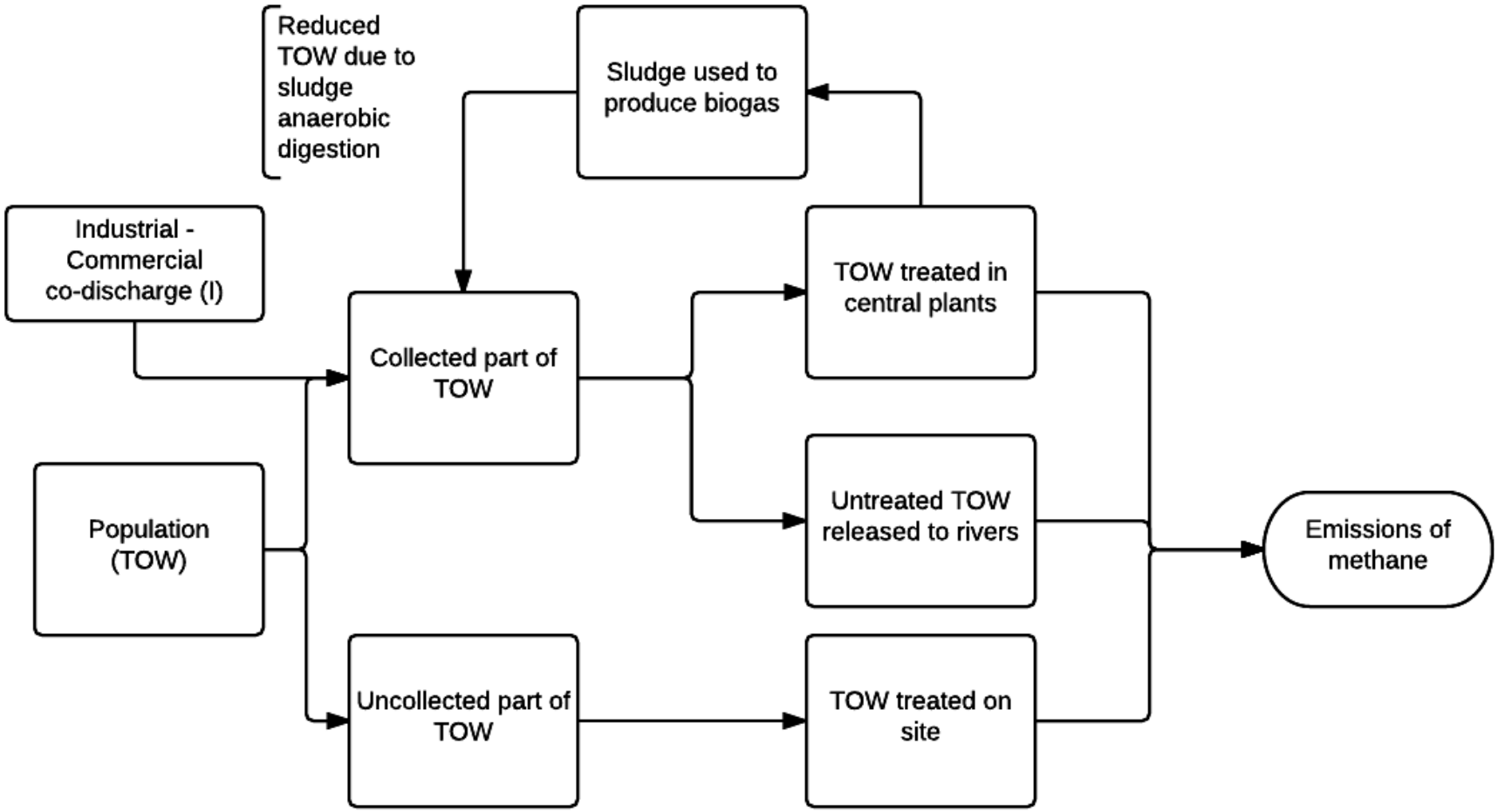

Fig. 2 The scheme of total organic waste flow in 5.D.1 (Fig. 7-11 in Czech NIR)

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5.D.1 data & methodology (from NIRp. 334)

- Conditions and data sources (copy of NIR):
  - The number of inhabitants (source: Czech Statistical Office, CzSO)
  - The organic pollution produced per inhabitant (source: IPCC default value)
  - The content of organic pollution in municipal wastewater and sludge is given as BOD_5 (the Biochemical Oxygen Demand).
  - The conditions under which the wastewater is treated (source: Czech Statistical Office)
  - The water is treated in well managed wastewater treatment plants.
  - The amount of proteins in the diet of the population (source: FAO)
  - The amount of biogas produced from wastewater treatment plants (source: MIT)

5.D.1 data & methodology (from NIR)

Tab. 2 Methane correction factor values for different method of water treatment (Tab. 7-17 in NIR)

	Uncollected TOW emissions [kt of CH_4]	Untreated TOW emissions [kt of CH_4]	Treated TOW emissions [kt of CH_4]
MCF	0.3	0.1	0.1

Tab. 3 Another parameters used for 5.D.1 (Tab. 7-16 in NIR)

B_0 [kg CH_4/kg BOD]	TOW [g BOD/ person/day]	Correction factor for industrial co-discharge	NCV of CH_4 [MJ/kg]
0.6	60	1.25	50.009

Tab. 4 Parametres for N_2O in 5.D.1 (Tab. 7-18 in NIR)

Fnpr [kg N/kg protein]	Fnon-con	Find-com	EF [kg N_2O/kg N]
0.16	1.25	1.25	0.005

TOW - total organically degradable material in wastewater; MCF – methane correction factor; B_0 - maximum methane producing capacity; BOD – biological oxygen demand; NCV – net calorific value, Fnpr - Fnpr - Fraction of Nitrogen in Protein; Fnon-con - Factor for Non-consumed Protein Added to the Wastewater; Find-com - Factor for Industrial and Commercial Co-discharged Protein into the Sewer System

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5.D.1 data & methodology (from NIR, p. 335)

- The methodological steps as follows:

- Estimation of the total TOW of the country by using the population and default BOD value production.
- Split total TOW into two streams, one is corresponding to TOW collected by central wastewater treatment plants and the other to uncollected TOW (mixture of latrines, septic tanks, root treatment plants and household biodisc plants, etc.).
- Uncollected TOW is multiplied by the implied EF based on IPCC 2006 Gl. resulting in methane emissions.
- Collected TOW is multiplied by the default co-discharge correction factor.
- Biogas produced by wastewater treatment plants is converted to the TOW required to produce this biogas and is substracted from collected TOW.
- Collected TOW is divided into two streams treated TOW and untreated TOW.
- Treated TOW is treated by well managed central treatment plants (default factors) resulting in methane emissions.
- Untreated TOW is discharged into watersheds resulting in methane emissions.
- Methane emissions from all three sources are summed up resulting in emissions from this source category.

5.D.2 scheme

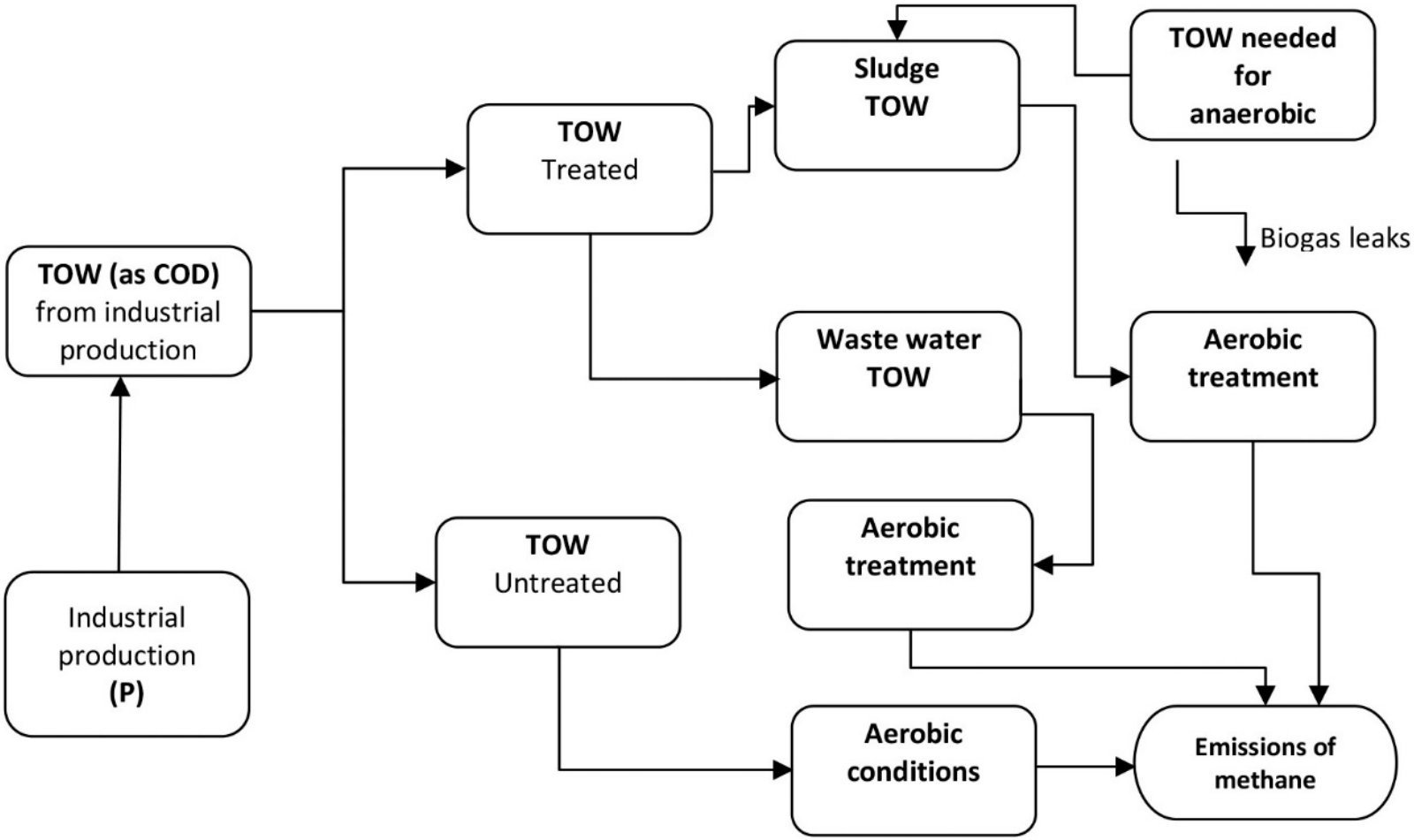

Fig. 3 The scheme of total organic waste flow in 5.D.2 (Fig. 7-13 in Czech NIR)

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5.D.2 Data & methodology

- collected wastewater is separated into wastewater and sludge (only small % of wastewater is discharged to lakes or rivers)
  - wastewater is treated in well managed wastewater treatment plants => aerobically => no emissions
  - sludge is tretaed anaerobically (methane recovery and emissions 5 % leakage) or aerobically => emissions calculated
- default values used
- B_0 = 0.25 kg CH_4/kg COD (maximum methane producing rate in accordance with Czech study)

Reporting year

- June/July – approximative inventure, some data (CzSO) available
- October-December – preparing for the first submission, almost all data available x FAOSTAT not actualizing every year
- January/February – finalizing the values
- rest of the year – review process and improving of the methodology or work with data

Thank you!