

Environmental risk assessment of agriculture soils towards food safety and food security requirements

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SCENARIO
The organic carbon (OC) content of agriculture soils is acknowledged as a key factor to guarantee the food security. Biosolids from civil wastewater treatment plants (WWTPs) have been proposed as a direct OC source, and may enter up to 35% in the composition of other top soil improvers (TSI) such as digestates, and mixed composts. On Mediterranean soils with an averaged OC content of 50 tons/ha, OC inputs from TSI may reach 10 tons/ha/year. The driving force consists on the regular use of WWTPs-derived TSI. The pressure results from the soil burden of bioaccumulative persistent organic pollutants, and other chemicals that concentrate in biosolids due to their high affinity for the OC (K_{OC}). Impact on the food chain and related intakes.

BACKGROUND INFORMATIONS
In Mediterranean grazing herds, top soil intake ranges between 6 and 20% of the daily forages dry matter intake
In laying hen: 20–60 g soil/head/day (worms included).



Comparison of agriculture soil median and mean inputs from biosolids (BSO) and mixed composts / digestates (MCO) with those from min-max airborne depositions referred to not impacted Mediterranean rural areas: air/biosolids air/compost ratio as indicator of the major contributors. na = not applicable.

	BSO	MCO/DIG	AIR*	air/BSO	air/MCO
PCDD/F+DL-PCBs (ngWHO-TE/ha/year)					
Median	56,450	na	5,475	0.10	na
Mean	78,950	193,550	8,395	0.11	0.04
Σ6 PCB (µg/ha/year)					
median	93,000	na	4,015	0.04	na
mean	220,150	330,750	8,760	0.04	0.03
BDE no. 47 (µg/ha/year)					
median	60,750	na	495	<0.01	na
mean	55,250	129,395	126	<0.01	<0.01
BDE no. 99 (µg/ha/year)					
median	88,500	na	347	<0.01	na
mean	79,000	188,300	105	<0.01	<0.01
PFOS (µg/ha/year)					
median	41,250	na	36,000	0.87	na
mean	62,750	94,500	54,000	0.86	0.57

* Air values referred to the min/max range

FACTORS CONSIDERED IN THE SOIL-TO-FOOD CARRY-OVER OF CHEMICALS

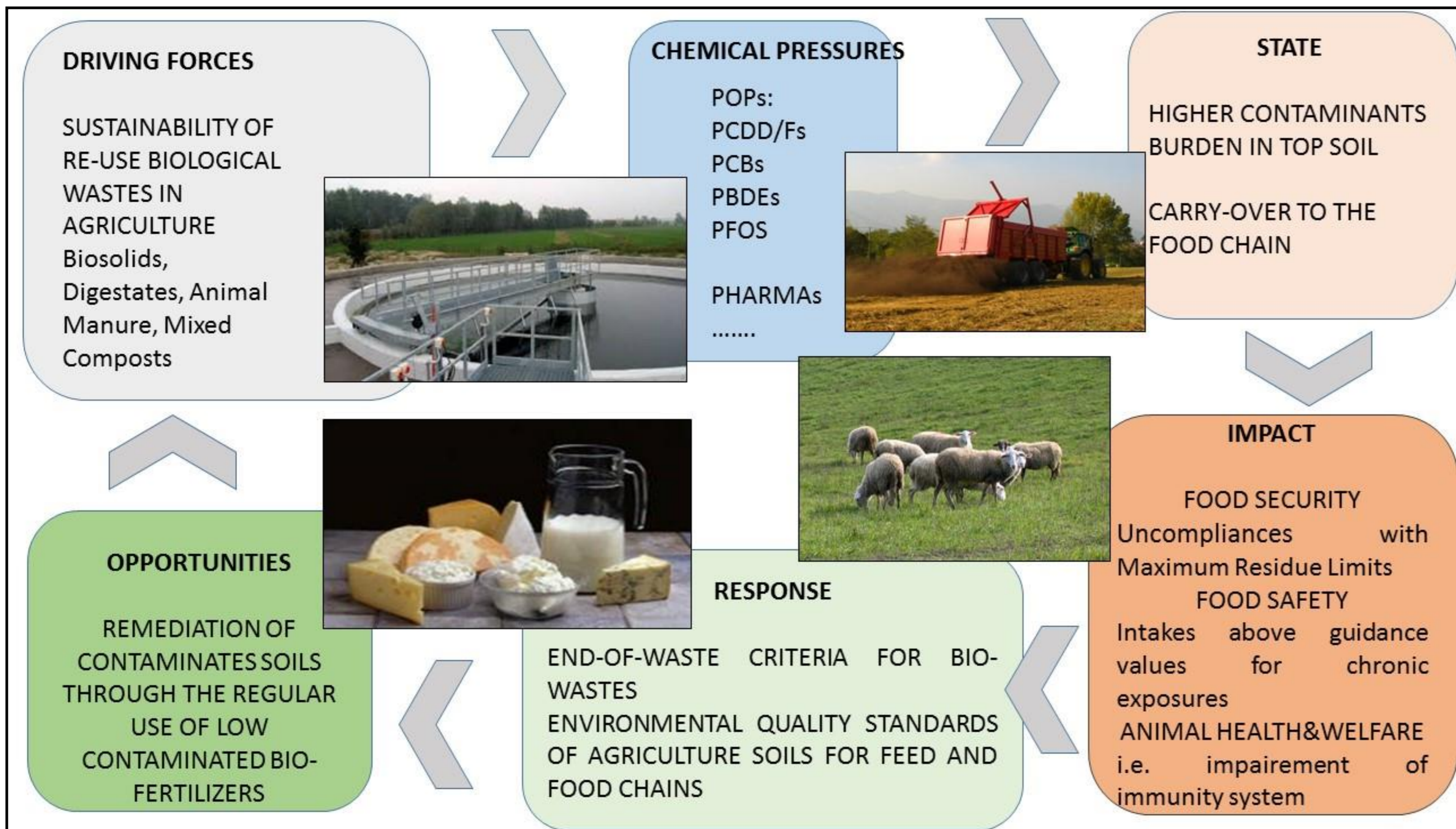
- Top soil burdens related to the agronomic use of TSI
- Direct Soil intake via grazing and hay ingestion
- Direct soil intake via water/sediments
- Contaminants uptake by plants of feed/food interest
- Pharmacokinetics in food producing animals
- Animal Productive Parameters
- Food Consumption Database

Reference Residue Values (RRV) expressed both on fresh weight (fw) and lipid base (lb) computed on the corresponding guidance level for intakes, accounting for the average contribution of dairy products to alimentary exposure, and the amount of dairy products consumed in Italian children 3-9 year from Southern Italy. Between brackets, occurrence values in sheep milk from national low-impacted rural areas. Na = not available.

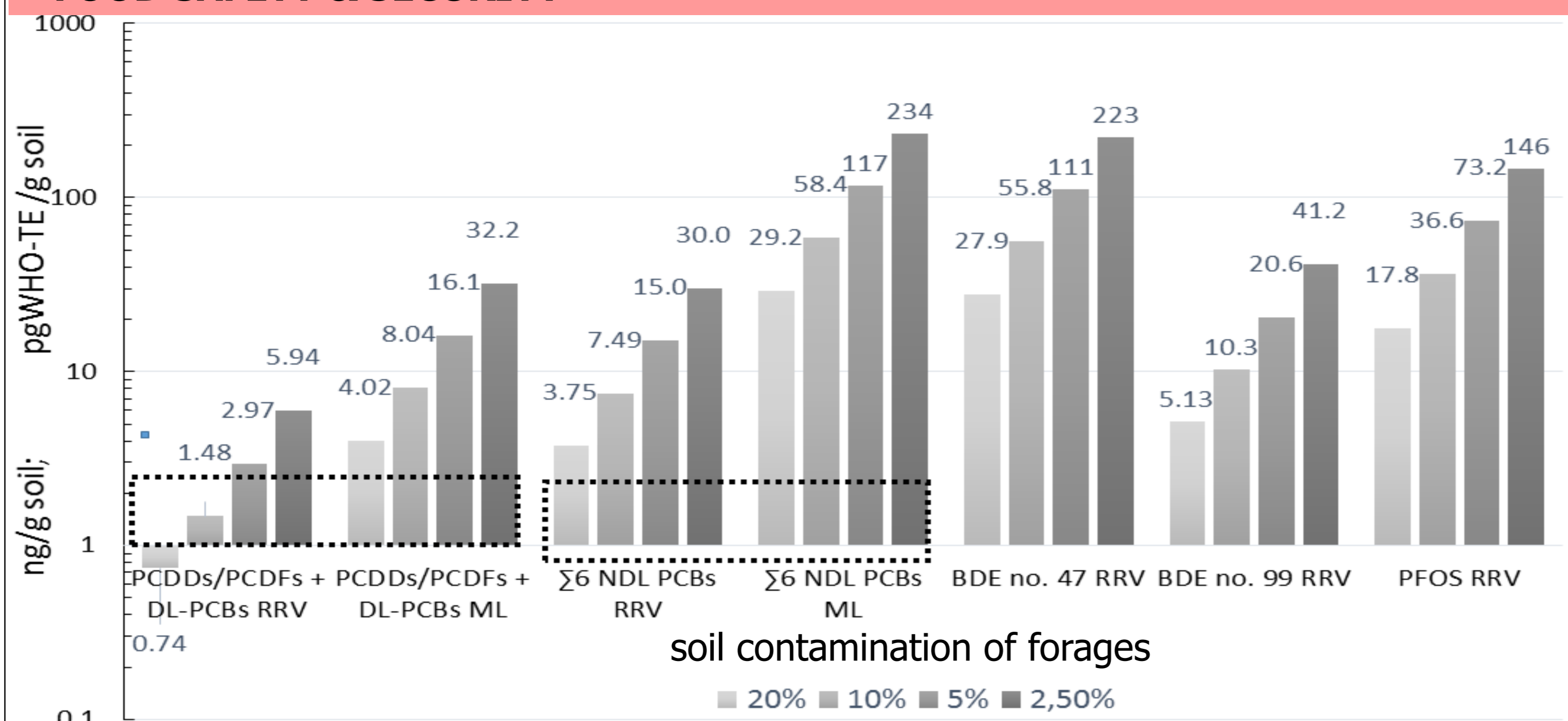
Compounds	TDI/BMDL	Dairy Children 3-9y intake		RRV		
		kg bw/day	%	g/kg bw/day	ng/g fw	ng/g lb
PCDD/F + DL PCB	2 pg WHO-TE	0.38	11.4	0.07	1.02	(0.72)
PFOS	150 ng	0.06	11.4	0.79	na	(0.02)
BDE 47	270 ng	0.26	11.4	6.20	95.5	(51.8)
BDE 99	4.1 ng	0.41	11.4	0.15	2.28	(55.1)
Σ6 NDL-PCB	10	0.38	11.4	0.33	5.28	(1.6)

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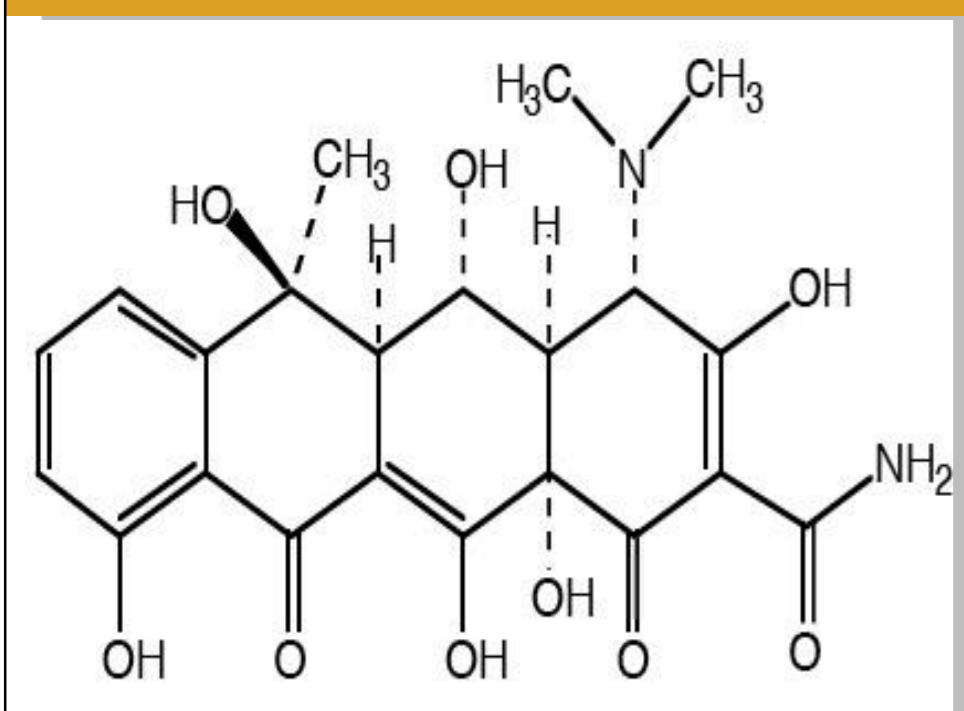
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EQS FOR SELECTED POPs IN AGRICULTURAL SOIL TAILORED ON DAIRY FARMING, ACCOUNTING FOR RELATIVE INTAKES (RRV) AND FOR MAXIMUM RESIDUE LIMITS (ML). BOXED AREA INDICATE BASELINE SOIL CONTAMINATION – FOOD SAFETY & SECURITY



EQS FOR THE ANTIMICROBIAL OXYTETRACYCLINE IN EGGS FROM RURAL FLOCKS - FOOD SECURITY



- Soil contamination 10 – 100 mg/kg dm
- Soil intake = 60 g/head/day (50% of feed dry matter intake)
- Egg production = 50 g/head/day
- COR soil-to-egg= 0.0033
- Expected concentration in egg: 40 – 400 ng/g
- Maximum Residue Level= 100 ng/g
- LOQ of relevance for organic claims = 10 ng/g

TO CONCLUDE,

EQS for agriculture soil tailored on food security/food safety are envisaged both for rural and urban farming systems.

Such EQS may represent the starting point for the definition of the End-of-Waste criteria referred to top soil improvers.

Such criteria should account for the health risk from the combined toxicity of chemical pollutants, pharmaco-resistance informations and human and animals pathogens, under a global health perspective.